

ANIMAL KINGDOM
NEW YORK ZOOLOGICAL SOCIETY



—◆—
VOLUME LVIII
JANUARY TO DECEMBER, 1955
NUMBERS 1-6
—◆—

INSTRUCTIONS TO BINDER

The 4-page signature forming the first 2 and the last 2 pages of this issue should be inserted ahead of the cover of Vol. LVIII, No. 1, in binding the volume.



590.673

A59

V. 58-59

1955-56

Contents

No. 1. JANUARY-FEBRUARY

The Gold Medal	Fairfield Osborn	1
Malayan Seladang	Charles S. Ogilvie	2
Lake Petén Molliés Again	Myron Gordon	13
Picture News from the Zoo	Sam Dunton	15
All on the Theme of Conservation	Stephen W. Bergen	18
The Adaptable Wren	Edward A. Armstrong	21
Gecko, the Chirping Reptile	James A. Oliver	25
News from the Conservation Foundation		28
Behind the Scenes		29

No. 2. MARCH-APRIL

Trustees for Animals	Fairfield Osborn	33
The Bower-birds	A. J. Marshall	34
Big Bluff from Australia	James A. Oliver	44
Spring Comes Along	Donald T. Carlisle	47
Zoo News in Pictures	Sam Dunton	48
Those Puzzling "Little Toms"	Myron Gordon	50
Creatures of Sea Ice and Tundra Barren	Katharine Scherman & Richard S. Miller	56
News from the Conservation Foundation		61
Behind the Scenes		62

No. 3. MAY-JUNE

The Magnetism of Animals	Fairfield Osborn	65
Banana Bonanza	James A. Oliver	66
How Birds Handle Their Population Problem	Alexander F. Skutch	72
The Fish with Holes in Its Head	James W. Atz	77
Black Bear Cubs at Last	Sam Dunton	80
Nine-banded Armadillo — Invader from the South	G. Dale Buchanan	82
A Summer in Asia	William Beebe	89
News from the Conservation Foundation		90
Behind the Scenes		91
Wild Animals We Will Never Know		95

No. 4. JULY-AUGUST

Jubilee Days at the Zoological Park	<i>Fairfield Osborn</i>	97
Nature Spreads a Varied Table	<i>William J. Hamilton, Jr.</i>	98
The Black Howlers of Barro Colorado	<i>Charles H. Southwick</i>	104
Mid-summer in the Zoo	<i>Sam Dunton</i>	110
A Rattlesnake's Strike	<i>Henry M. Lester</i>	116
We're Sorry for Andrew Burr, Jr.		123
News from the Conservation Foundation		125
Behind the Scenes		126

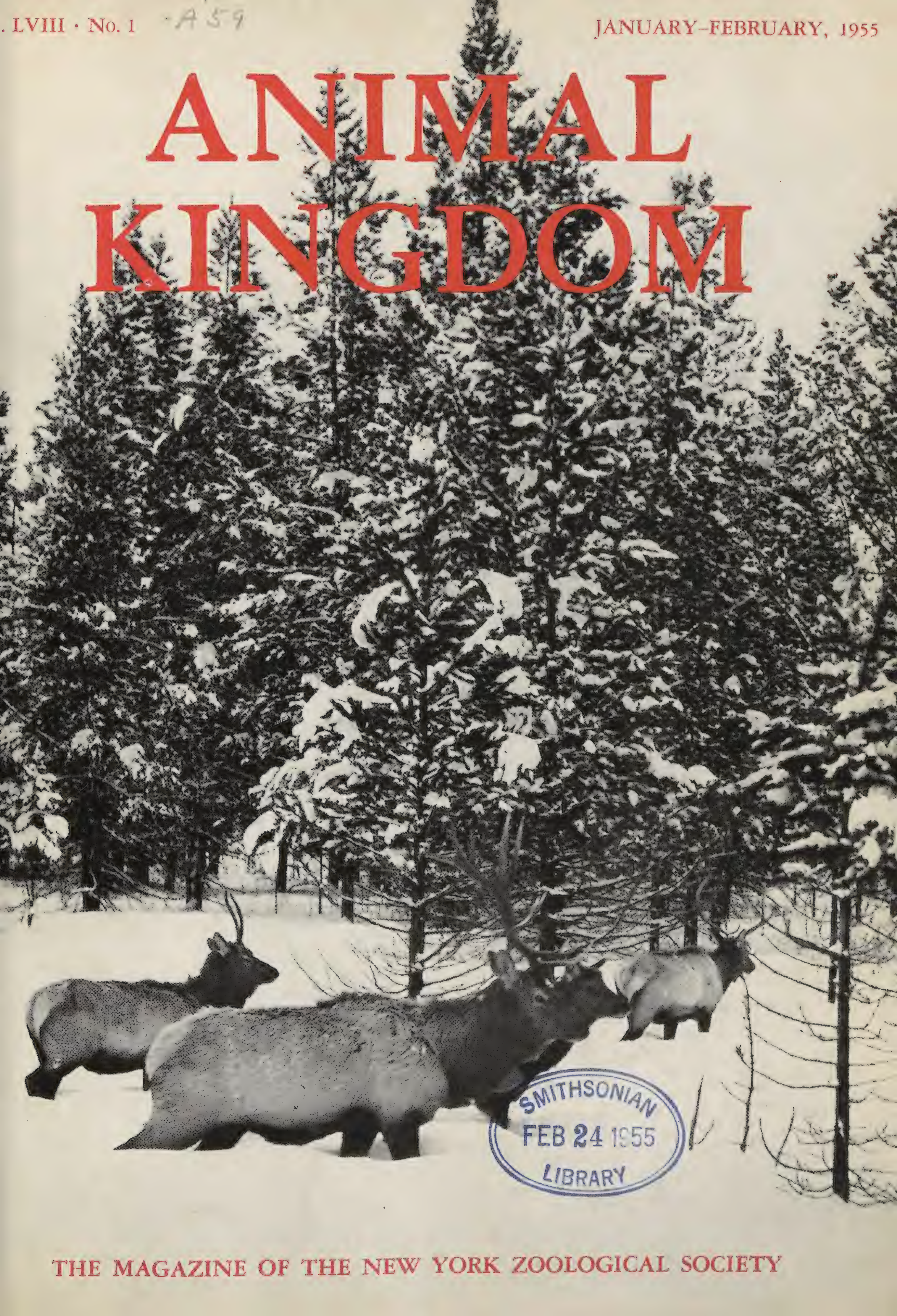
No. 5. SEPTEMBER-OCTOBER

Animal Personalities	<i>Fairfield Osborn</i>	129
The Cheetah — the Mildest Cat	<i>William Bridges</i>	130
Newsletter from Karachi	<i>William Beebe</i>	135
How's the New Aquarium Coming Along?	<i>Christopher W. Coates</i>	137
The Fable of the Sloth and the Cheetah	<i>Donald T. Carlisle</i>	139
Zoo Picture Pages	<i>Sam Dunton</i>	140
The Riddle of the Ridley	<i>Archie Carr</i>	146
News from the Conservation Foundation		153
Behind the Scenes		154

No. 6. NOVEMBER-DECEMBER

Livingroom for Animals	<i>Fairfield Osborn</i>	161
The Lowland Gorilla	<i>Lucien Blancou</i>	162
Where Do Animals Go in Winter-time?	<i>William J. Hamilton, Jr.</i>	170
In the Bag with Andy	<i>Sam Dunton</i>	176
New Arrivals and News	<i>Sam Dunton</i>	179
Zoo-goer in Asia	<i>William Beebe</i>	182
News from the Conservation Foundation		187
'56 Will Be a Great Year		188
Behind the Scenes		189
Index to Volume LVIII		190

ANIMAL KINGDOM



SMITHSONIAN
FEB 24 1955
LIBRARY

NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

Peter M. Stern

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

Jackson Hole Elk	Cover
Malayan Seladang	
Charles S. Ogilvie	2
Lake Petén Mollies Again	
Myron Gordon	13
Picture News from the Zoo	
Photos by Sam Dunton	15
All on the Theme of Conservation	
Stephen W. Bergen	18
The Adaptable Wren	
Edward A. Armstrong	21
Gecko, the Chirping Reptile	
James A. Oliver	25
News from the Conservation Foundation	28
Behind the Scenes	29

Vol. LVIII FEBRUARY 1955 No. 1

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

The Gold Medal

WITHIN THE LAST DECADE the Gold Medal of our Society has been awarded four times. It is not given *perforce*, so to speak, for there is no compulsion to award it annually. Consequently it is only given when it seems that some individual has conspicuously served one or more of the purposes of our institution.

A prince among men and a leader in the cause of conservation, Frederic C. Walcott, received it in 1946. Then there was a pause for awhile and now, within the last three years, it has been awarded successively to Rachel Carson, in 1953, as interpreter of life within the oceans, last year to Robert M. Yerkes as an eminent pioneer in psychobiology, and this year to Konrad Z. Lorenz as a gifted and patient translator of the actions of animals. Dr. Lorenz has been extraordinary in his contributions to the understanding of animal life. Julian Huxley, in his foreword to Dr. Lorenz's recent book, *KING SOLOMON'S RING*, writes "... Lorenz has done more than any single man to establish the principles (of animal behavior) and to formulate the essential ideas behind them. And then Lorenz has given himself over, body and soul, to his self-appointed task of really understanding animals, more thoroughly than any other biologist-naturalist that I can think of. This has involved keeping his objects of study in what amounts to the wild state, with full freedom of movement. His readers will discover all that this has meant in the way of hard work and inconvenience — sometimes amusing in retrospect, but usually awkward enough or even serious at the time."

The world of nature is fortunate that there are such people as these. Our Gold Medal serves as a token of the admiration of our Society for their accomplishments.

Fairfield Osborn



The author's observation platform overlooking a salt-lick glade deep in the forest. Seladang and elephants, deer, tapirs, wild pigs and a host of other animals come to this open spot.

All photographs by the Author

SELADANG, pronounced "slah-dahng," is a synonym for Gaur, and is the Malay for this the grandest of the Ox tribe. It is known to science as *Bos gaurus*. In India and Burma, where it reaches its greatest size, it has commonly been known to sportsmen as the Bison. It is considered by them, as it is by sportsmen in Malaya, the most magnificent animal of the chase. Perhaps they are right in this, for to track through heavy forest a great old bull of this species, and to bring it to earth after a long and very arduous trek, is no mean feat. It must live very long in hunters' memories.

I have never killed a Seladang and have never wanted to. Perhaps I have some bovine blood in my early ancestry. Be that as it may, I have been called upon to destroy other great beasts which

A GAME WARDEN
LOOKS AT THE

MALAYAN SELADANG

By CHARLES S. OGILVIE

*Acting Chief Game Warden,
Federation of Malaya*

had put themselves beyond the pale. That was a duty and caused no heartburn until the hunt was over. One cannot love animals and shoot them without horrible after-feelings; at least when one's blood has cooled from its youthful heat. For thirty-six of my fifty-nine years it has been my very good fortune to be in Malaya. During all that time I have been intensely interested in our indigenous fauna and for the past seventeen years it has been my privilege to serve that country as Game Warden. That has allowed me all my days and nights to study some of our rich fauna, and what follows are some of my gleanings. These relate to the Seladang, their behavior and their reactions in the presence of man and some other animals.

A large bull of the species may stand as high as six feet at the highest point of its great dorsal ridge. It has been estimated by many observers that such a beast may weigh well over 2,000 pounds. The cows are smaller, but some I have observed have been quite bull-like in appearance and bulky too. Such may easily be mistaken for a fair bull by one who is no novice in the observation of Seladang. They are very uncommon and after but little experience the novice may easily differentiate the sexes by the appearance of their horns.

Calves at birth have the body color a pale red

fawn to a pale brick red. They also possess a long dark bay dorsal stripe which submerges into the color scheme of the coat as the beast matures. All animals, both young and old, have four distinct white stockings. In mature beasts the body color over the back and sides is very deep dark bay and has often been described as black in old bulls. The color recorded depends upon the light and upon the angle at which the beast is viewed. Sometimes, seen from a position astern, quite a reddish color is recorded by the observers' eyes in even very old animals. By the time a calf has reached the age of one month its body coat starts to darken. By the age of two months it is patchy

red and brown. By four months it has become an even dark brown, and at six months an even light bay. So on it keeps darkening until at two years it has become a deep dark bay.

All Seladang I have observed in life possess a distinct dewlap which is noticeable at the tenderest age. This dewlap develops with age, as does a fringe along it of sparse, long, dark hairs. So, too, a general feature is the high arch

Some of the characters in the little dramas of the glade. The Seladang cow, Curlyhorn, is in the center with one of her twin calves. Bullhead, another cow, is behind her, looking toward the thick forest.



between the horns of the Malayan Seladang. Both the dewlap and the raised arch are easily discernible in very many of my Seladang photographs. One of the most distinguishing features of all Seladang is the presence of a very long and high dorsal ridge. This, with its great depth of body, makes it a most imposing animal. The legs and feet in Seladang seem small in proportion to the rest of their bulk; nevertheless they are all-sufficient to this most powerful beast. When needed they can carry that great bulk at a terrific speed.

Man is probably the most feared beast of all where Seladang are concerned. They abhor his odor. They are only too glad to give him a very wide berth. Yet they take advantage of his industry. It is chiefly due to our primitive people that they are able to enjoy rich grazing which would not otherwise be available. Primitive man with his shifting cultivation fells the forest, grows and takes off his crops, and moves further on to fell again. This leaves abandoned areas which for some years produce luscious fodder for the Seladang before reverting to secondary forest.

In the study of these animals man must be circumspect in his approach. He must avoid his scent reaching them as he must be sure he is unseen and unheard by them. Of course there are times in the jungles when, moving very quietly, he may virtually almost bump into a resting herd or lone animal. If a herd, pandemonium breaks loose as the beasts scatter and stampede away. Seladang while in the cover of forest are far more nervous than when grazing or resting in open clearings. On a number of occasions while quietly walking along a path in the heart of a jungle I have come face to face with old bull Seladang as well as younger ones. This would not have happened had the drift of air been faster than my speed from me to them. There was no variation in their reaction when this happened. The beast stopped short, facing me at anything from ten to twenty paces, threw up his head and stared hard as if puzzled, stamped and even approached a couple of paces. Finally, when he was certain that the still and silent form blocking his path was man, there was an explosive snort before he wheeled suddenly about and crashed away the way he had come.

Seladang while in open clearings and in the

glades of salt-licks in the forest are not nearly so wary once they have spent some minutes there. If a herd is present in such a situation some cow will most certainly have her head up. If while she does this sentry duty the faintest tinge of peril is wafted to her nostrils, she becomes doubly wary. Her nose goes out and her nostrils weigh the scent. First to her front and then in other directions. Should she feel that the scent denotes real danger, she will by her action have pin-pointed its direction and she will suddenly wheel away and stampede a short distance before again turning to face the threatening situation. Her behavior brings all members of the herd fully alive to the danger, and they follow her example, forming a loose knot facing the source of any possible onslaught. Only a fraction of time is spent thus before they wheel again and gallop off into the cover of the forest.

Herd bulls do not undertake these watchdog duties but leave them to their wives. The latter naturally are more efficient, for they have all had to be very much upon their toes when they had calves running with them. Nevertheless the bull quickly acts on the danger signal and places himself at the head of his herd when facing danger. He also, like a good commander, generally takes position in the rear during such retirements. Unwounded Seladang, and Seladang cows without very young calves do not, as is popularly believed, charge man on sight. They are only too anxious to get away from him. A wounded Seladang bull or cow, or a cow with a calf that cannot yet move freely, may charge man, however. The cow with such a calf will do so at once if man should approach too close to or stumble upon a hidden calf.

I have only once driven a car in among a herd of Seladang. Their reaction was interesting. So long as I remained in the car the Seladang stood about, but as soon as I got down and separated myself from the car they stood not on the order of their going. So, too, on some of our rivers where outboard motor boats are used frequently, I have passed Seladang standing on the banks within twenty paces of the boat as I roared by.

In 1947, as Game Warden superintending King George V National Park, I was aware that at odd times a herd of Seladang visited the environs of the park headquarters at Kuala Tahan.

They did not then approach closely to the busy settlement there. From time to time until 1950 I observed the herds in various situations to within a quarter of a mile of our settlement, and even closer over the Tahan and Tembeling Rivers. But always it was us who approached them. If we came upon them suddenly, they stampeded away. By approaching stealthily under cover one could get reasonably close to them and make observations, but invariably the click of a camera shutter even at fifty yards would make them positively uneasy. The faintest scent of man at distances under eighty yards would cause them to bunch and bolt to the cover of the forest. If in the forest they bolted deeper into the forest.

It was then I decided I would bring the Seladang to us. It did not take as long as I imagined. The jungle at the back of the settlement had been used for a number of years by all and sundry for the collection of firewood, timber and other building necessities. I closed to man that part of the jungle which lay at the back of the settlement to a depth of two miles. No man, woman or child on pain of instant dismissal has been allowed to enter there since. Within two months of my closing that area Seladang were grazing on the forest edge about one hundred and fifty yards behind my barn home.

They remained in that jungle for some weeks and daily became bolder in their approach to man. A fence sixty yards behind my barn they grazed up to nightly and to within thirty yards of

Primitive people in Malaya clear areas of the forest and then move on, leaving open fields that soon grow up in grass. These "pastures" make attractive grazing grounds for Seladang.

it in broad daylight. Later I moved the fence thirty yards closer to "The Barn." The Seladang at once took advantage of the extra grazing thus provided. Today when the herd are in at Kuala Tahan they may be seen grazing or lying ruminating in the open beyond the fence at any hour of the day, but more usually they appear in the late afternoon and retire to the cover of the forest in the morning before the sun gets too hot for their liking.

The running of engines on the river and in the

settlement does not bother them. The screaming of children and the shouting of men likewise bothers them not. The sawing, banging, clanging and hammering that takes place in a normal day's work in the settlement they are now accustomed to and they heed it not at all. To make the beasts of the herd raise their heads to pose for a picture at a range of fifty yards from the observation hide requires a very goodly shout. Even then



their heads are soon down to the serious job of filling their maws. This direct shouting at close range should but very seldom be indulged in as too much of it does make them uneasy and inclined to retire. I have seen a party of some twelve gaily clothed persons, at six o'clock of an evening, standing together talking and gesticulating in the open within seventy yards of these Seladang. Yet after a brief survey of the party the herd grazed on undisturbed. But let no man approach them closer than that, directly and in the open,



for though these Seladang will not then stampede they will move towards the forest uneasily.

If one could live completely alone at Kuala Tahan for a number of years with all fences removed, I am convinced one could hand-feed the beasts like domestic cattle. And who knows but in time one might even milk the cows! These Seladang quickly become used to powerful flood-lamps shining out on to their grazing ground from the fence line. It was not so long before they grazed even close in to the full glaring beams of these powerful lamps.

Seladang react differently with mammals other than man. Seladang and Sambar Deer may be seen grazing in the same open glade in the forest, but during observations when both were present it was noted that they do not mix. Invariably they feed well apart, though neither seems to have any antipathy towards the other. Some-

A Sambar Deer has come to a salt-lick glade in the forest. Seladang and Sambar often frequent the same glades, but do not mix. The call of the deer serves to warn the Seladang of a nearby Tiger

times when Seladang are in the open grazing, suddenly it will be observed that the herd have thrown up their heads and are gazing intently at a spot on the forest edge. Perhaps a minute or more later a Sambar Deer steps out and may pass within a few yards of the herd, and perhaps later another and another may appear the same way. They keep to themselves and the Seladang return to their grazing.

The Sambar Deer are of a distinctly more nervous temperament than the Seladang. They have need to be for they are so much more vulnerable to the tiger, being possibly its most favored food. They are forever on their toes, and

literally so. Often through the Sambar's wariness the Seladang are alerted when tigers are nearby; the sudden startling bell of a Sambar in the presence of Seladang brings the whole herd to attention and watchful.

This is clearly shown by an experience I had in 1939 in Krau Game Reserve.

One evening I was approaching the abandoned clearing of an aboriginal tribe. I had with me a young Game Ranger and my friend Begng. Begng belongs to the Che Wong, a little known primitive tribe. His knowledge of life in his forest is very great. As we drew near the clearing's edge a bull Seladang bellowed. We made our approach even more stealthily and arrived at a huge termite nest on the clearing's edge. This termite's nest had sparse coarse grass growing about its base that would not have hidden from view a domestic cat. I halted my companions some paces behind and edged forward to my right to view the clearing better, but could see no animal to my front. As I edged further forward to get a view 'round the anthill, a startled Sambar Deer belled in my right ear and raced away across the clearing.

Startled by the sudden terrific noise I jumped, and a moment later was peering 'round the anthill. There at about forty paces stood a herd of eight Seladang, including a fine old bull. All heads were up and looking in the direction of the startled Sambar. After counting the Seladang several times and making a mind picture of them for my notes, I turned back to signal to my companions. As I raised my hand and beckoned, a tiger rose from a prone position at the base of the anthill and leaped out of sight, giving an angry "ahauh." With nothing but a tiny Malay golok (a small bush knife) in my hand, my reaction does not concern this narrative, but when I was able to collect my wits I turned back to see what the Seladang were doing. They were still there and had moved forward five or six paces in the direction of the tiger's angry voice. In doing so they had bunched, with the bull half a length forward, cows to the right and left while the smaller fry could barely be seen in the knot. I am afraid I was careless; at any rate I was so engrossed that I exposed myself to them and they undoubtedly mistook me for the tiger and approached menacingly but slowly. I was flum-

moxed and backed slowly into the open. They stopped and glowered malevolently and while I continued my slow walk backwards, still stood their ground (they had not caught my scent, as the wind was from them). I still continued backwards while they remained closely bunched, glaring balefully across the short intervening space; the space widened and eventually I found myself in the cover of the forest. My two companions had already made themselves scarce on seeing the tiger.

Seladang under normal conditions fear man, and either sound or sight of him is enough to set them on the run. Not so when tigers are concerned; they may fear tiger, but they know their combined strength and are prepared to stand and fight rather than run. The tiger mentioned here would have been shredded had he attacked that knot of angry beasts. In passing, it might be noted how invisible tigers may be. How all three of us failed to notice this one was beyond our understanding. How that beast stayed frozen while I chased away its dinner, the Sambar, walked past its nose, and then came back and stood beside it beckoning, is still beyond my comprehension, but the fact remains. Practically standing on its toes proved the last straw. I was not its meat and the tiger went; but I do think angrily.

Tigers do certainly take a few young Seladang from the herd. Three Seladang calves under a year old were devoured by tiger from the herd in 1953, and at odd times in previous years some older beasts as well as calves have disappeared from the herd when tigers were known to be in the same locality.

Seladang grazing in the open are quick to detect the hidden presence of wild pigs; very much quicker than man, the patient observer. Their reaction is much the same as with the Sambar Deer: heads up and facing one direction towards the forest. Once the pig, or pigs, have appeared, the Seladang return to their preoccupation. On numerous occasions I have observed pigs up to seventeen in number appear like this, and scuttle slowly with brief halts with their snouts to the ground as they passed closely the Seladang herd. Pigs too are extremely wary, for like the Sambar Deer they are a very much favored food of the huge cats. The wild pig is

a very wise animal and all its senses of sight, hearing and smell are highly developed. A startled snort from a pig of a sounder send them all scuttling at high speed. This snort, too, warns Seladang of danger and gives them time to meet it adequately.

Seladang and elephants do not mix in their

mutual habitat. Seladang which may have spent some weeks in and about some favored grazing ground or salt-lick are quick to vacate their tenement when elephants push their long noses in. They have little in common. The elephant being the enormous beast it is has little to fear other than man. Thus it is to be expected that Seladang will get no warning shout from them in the presence of a mortal enemy. Though tigers are known at times to attack elephants, their screaming and trumpeting may merely be a domestic family squabble. Seladang mistrusts those who call wolf at all times.

The jungle fowl is surely the Seladang's best friend and the partnership is by no means one-sided, for the Seladang grazing and cropping grass disturbs a wealth of insect life which goes to fill the fowls' crops. It is no uncommon sight

LEFT — A young wild boar beside the skeletal remains of a Seladang. Even dried bones are grist to his mill. BELOW — Wild pigs wallow in a clearing. They, too, warn Seladang of the approach of danger.



to see a number of jungle fowls dashing about under the bellies of the Seladang, stuffing themselves with grasshoppers and other exposed valuable protein foods. Is there any more wary animal than this selfsame jungle fowl? I doubt it. They seem to hear the unhearable and see the unseeable. They needs must exist in their world with a multitude of cats from the greatest to the least. They are so vulnerable to them all. Our sporting gunman knows their wariness. Our local hunters devise all methods of trap and device for their downfall, yet still their name is legion. Very often the first one knows of the presence of jungle fowl is a whirr of wings as they take off unseen. That sudden whirr of wings brings sleeping Seladang to their feet and wide awake; but let me continue some of their story from my nature notes.

1954, February: — Our heard of Seladang which I knew to be across the Tahan for some reason did not cross over to the grassy clearing behind my dwelling as is their usual habit. I believed this was caused by the presence in our settlement of Yatimah Puteh, our baby elephant, which at times was very loud-mouthed. Seladang and elephants do not generally mix. However, in this instance I was to prove wrong in my conclusion.

1954, March 4th: — Our herd of Seladang at 5:30 p.m. appeared behind my barn. A bright red calf, just a month old, was with them. It was only then that the true reason dawned on me why they had not returned before. I should have thought of it instead of blaming our baby elephant. I have known for years that when a Seladang calf is born the herd will never desert the dam and calf. They hang together until such time as the calf is old enough to move very freely and if necessary swim across a goodly river. This period is always a full month. I have remarked this often when calves have been born on our settlement side of the rivers. Nevertheless I am still aware that Seladang prefer their own company to that of elephants.

1954, March 5th: — Seladang out in force at 6 p.m. The herd of eleven head (old Curly Horn, the dam of several pairs of twins, is missing) came within thirty yards of my observation hide. The cow with the nasty gaping wound in the base of her horn is still much bothered by

her affliction: shaking her head and clawing in the wound with her off hind hoof, then licking the hoof so used. The month-old calf, a baby bull, is very frisky. He is named today "Red Coat," for he is redder than most at his age. While I sat watching the herd young Yatimah Puteh, our baby elephant, gave loud voice not far away. Every Seladang including Red Coat threw up its head, listened for some twenty seconds, then went on grazing. This was repeated some few minutes later but with little effect on the Seladang. They now obviously accepted Yatimah Puteh as of no more consequence than the rest of us at Kuala Tahan.

1954, March 6th to 10th: — Seladang observed grazing each day morning and evening.

1954, March 11th: — At 4:45 p.m. the herd was in. I entered the observation hide and sat and watched them. The calf, Red Coat, was suckled in the normal manner of domestic cattle for a full eight minutes by his dam. I have also observed Seladang calves suckled from behind in the way of domestic water-buffalo. With the herd were eight jungle fowl: three adult cocks, four adult hens and a well grown cockerel. They strutted around enjoying the insect life disturbed by the grazing Seladang. It was interesting to note how carefully the herd bull, Thin Horn, avoided putting his great hooves down on top of the cockerel. Once or twice he deliberately avoided doing so. Soon Thin Horn slumped down and lay chewing the cud near Sore Horn, who lay dozing with eyes closed. The perky young cockerel, who had been fussing about the bull, left him and strutted over to Sore Horn. There he hopped up on her dorsal ridge and thence to the arch between her horns. Sore Horn never moved and Dr. Cockerel at once proceeded to operate on the gaping wound in the base of her right horn. He spent three full minutes cleaning out the wound, during which time he must have removed a score of maggots, besides dead tissue. The operation successfully completed, like any other surgeon he left the operating table and dropped back to earth, there to strut off on his usual rounds. Sore Horn during the whole ordeal never moved, winced nor opened an eye. However, when the doctor was safely clear of the operating theatre, she opened her eyes, shook her head, rose to her feet and walked



The cow nicknamed Sorehorn is at the extreme right and the tiny object at the head of the arrow is her "surgeon," the Jungle Fowl cockerel which used to clean out her injured horn.

a hundred yards to a sapling on the forest fringe. There against the sapling she gave her head in the region of her wound a thorough rubbing, then back to the herd to fill her maw. The cow is still, after many months, suffering from her wound (I fear caused by a poacher's bullet fired on the herd's wandering outside the Park on the other side of the Tembeling River) but retains wonderful condition. Her mantle is a rich glossy dark bay and her muscles are full; so, too, is her torso and I expect soon to see another young calf with the herd.

1954, March 12th to 20th: — Seladang grazed daily in our home clearing.

1954, March 21st: — At 5:00 p.m. entered my observation hide. Only ten head of Seladang were

out cropping grass or lying chewing their cuds. Dr. Cockerel, two adult cocks and a hen jungle fowl were in attendance and gorging themselves on the plentiful insect life. Later the doctor got round to his patient, Sore Horn, and what followed was worth waiting years to observe. Sore Horn was stretched out on the grass ruminating. As the doctor approached her she stopped chewing her cud and as he drew quite close she thrust out her chin, laying her chin and throat pressed to the ground. That was not all: she then tilted her sick horn over towards the ground also. The doctor apparently appreciated not having to climb on to the operating table and forthwith set to, to clean her ugly wound. He did it as thoroughly as on the former occasion, then strutted off to join his companions. Sore Horn did not get up, just shook her head and continued chewing her cud where she had left off. Her whole action during the approach of the cockerel and her placid demeanor during the

cleaning of her wound indicates intelligence in a Seladang far beyond any I had previously credited the species with. It was hardly to be expected from these supposedly heavy-witted, dull, sluggish-brained animals.

1954, March 22nd: — The Seladang herd were out by 4:00 p.m. in the home clearing. A wild sow with well grown piglets led by a fair sized boar scuttled across the clearing between the hide and the Seladang. Neither took the slightest notice of the other. The Seladang, as usual, had attracted my attention to the pigs' approach long before I would otherwise have become aware of their presence, but long before they had arrived anywhere near, the herd had

These magnificent beasts are part of the herd that came regularly to the abandoned clearing in the King George V National Park in Malaya. The herd bull, Thinhorn, is at the lower left.

recognised them for what they were and gave them no further thought on their close approach.

1954, March 23rd: — 6:00 p.m. Seladang in force out grazing in home clearing. A Malay schoolmaster with three companions on their duty way to Ulu Tembeling saw Seladang for the first time in their lives. It is an unintelligible fact to me that these men of Malaya, Malays all of them, had never until now seen one of their own grand forest cattle. Do our schools teach nothing other than the three R's? It would seem not. What a pity.

1954, March 24th: — Seladang were at the salt hole in home clearing at 5:30 p.m. As I was about to enter the hide a cow, Bull Head, always a nervous beast, though the most magnificent of her sex, was screened from me only by the thickness of the palm-leaf-draped fence. As we, unknown to each other, stood shoulder to shoulder she must have got my stench. Any-



way, there was a minor atomic explosion close to my right ear, and taken unaware by the blast I had the wits scared out of me. She stampeded away to rejoin the herd, which also withdrew hurriedly some twenty paces. There they wheeled and stood in a loose knot glowering in my direction. Fortunately I have a loose skin, or surely I would have burst out of it at the detonation. It took me just as long as I am sure it did her to stop the pounding of my heart and regain normal equilibrium. All the animals were obviously alarmed but not unduly so. The herd bull gave a couple of low-throated roars, short but convincing of his intentions in any event. They stood thus loosely bunched for a while, but after a short minute they grazed apart and did not approach the salt hole again till near dark. One after another heads went down when they were convinced it was only a storm in a teacup. Bull Head remained very watchful for another two minutes. Then she, too, seemed to get over her fright and started grazing. Had this episode taken place in some old clearing far away from human habitation, deep in the forest, those Seladang would at once have stampeded away from the clearing to some great distance into the forest. They would certainly not have returned to the place for days, perhaps weeks or even months.

1954, March 25th: — From 5 to 6 p.m. I watched the eleven head of Seladang from a comfortable chair in home hide. A small cow, Blackstripe, the first born of Bull Head, was paying much attention to the herd bull, Thin Horn. He, looking quite bored, permitted himself to be thoroughly groomed about the face, ears and shoulders. When he had stood as much as he could take of this obvious courting, he slumped down where he stood and with his back to the young cow chewed his cud. I do think that young thing had every right to feel slighted. Dr. Cockerel and another very lovely jungle cock were there. Young Red Coat frisked about from time to time, then tiring of his play lay down and curled up. Had I not seen this young calf lie down I would never have spotted him. Though his coat is bright red and the grass all around quite green, there is something about the tones that make the detection of a calf at this stage impossible unless it moves. So it was with this

one. I could not have pointed him out to anyone who might have arrived on the scene then. The doctor strutted over in his professionally perky manner and inspected Sore Horn's wound as her head was down cropping the grass. He did not operate. Obviously he considered his patient was doing very well, and doubtless patted himself on the back as he minced away. It appeared like that, for he flapped his wings and gave a feeble crow.

March 26th: — Seladang are still at Kuala Tahan.

March 27th: — I watched the Seladang out in force from Home Hide from 4 to 6 p.m. Took some pictures of them on Kodachrome. One of these should show Red Coat in a patch of sunlight. A single fine jungle cock fussed among the herd.

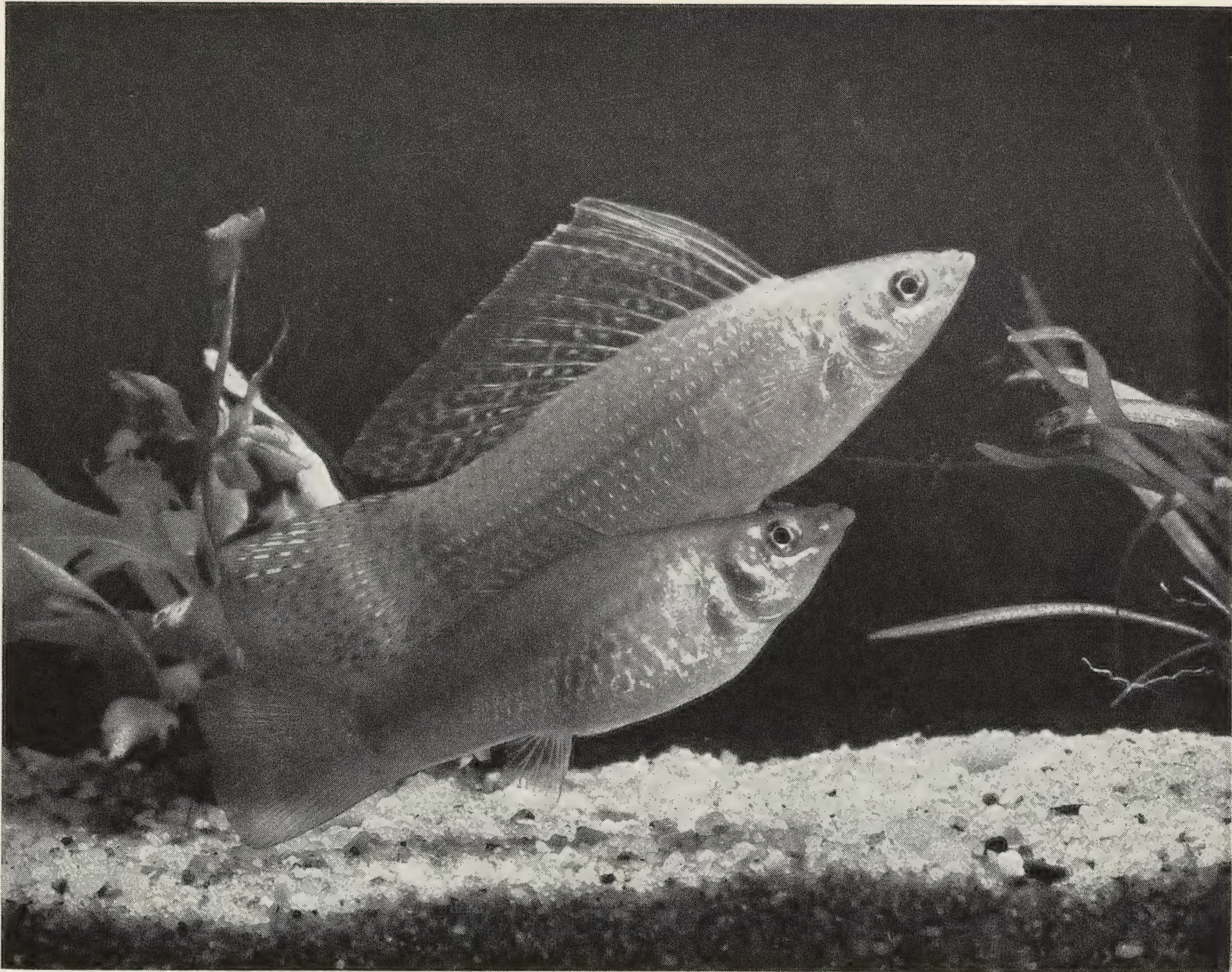
March 28th: — Seladang out in force morning and evening.

March 29th: — Watched Seladang herd from Home Hide from 4 to 6 p.m. Two jungle cocks were there, Dr. Cockerel one of them, but he paid no attention to his patient. It appears that she is only an out-patient now and probably has to queue with the crowd before she gets the attention of one less expert than her famous surgeon. A jungle hen joined the gathering just before I left them.

March 30th: — In very heavy rain the Seladang were at the salt hole in the home clearing at 3:30 p.m., and later came very close to the hide. During these very heavy rain squalls Seladang sometimes behave in an extraordinary manner. At such times they bunch, then break and scatter in all directions, becoming very skittish, from the youngest calf to the most sedate old cow. Even the ponderous great herd bull will then come suddenly to life and playfully mount a number of cows one after another. All will leap around flinging their hind heels high in the air. This even scares the jungle fowl, who take to wing for safety among so much madness.

March 31st: — Seladang lay ruminating in the home clearing until 7:30 a.m., when they retired to the cover of the forest. They did not reappear again this evening.*

* Grateful acknowledgement is made to the Malayan Nature Society for permission to use some of my notes published in Vol. 9, pages 1-10, of the *Malayan Nature Journal*, June, 1954.



This is a pair of the Lake Petén Mollie. Only fully adult males have the enormous, sail-like fin. The fish reaches a length of about five inches, making it one of the largest of the Mollies. First brought to this country in 1935, they were reintroduced by the Aquarium in 1954.

LAKE PETÉN

MOLLIES

AGAIN

By MYRON GORDON

THE Lake Petén Mollie, a giant fish by tropical aquarium fish fanciers' standards but one that would be rated only as a good-sized minnow by game fish enthusiasts, was found in Guatemala, brought back alive to the Zoological Society's Aquarium and displayed there for the first time during the summer of 1954. Little was known about this beautiful, five-inch-long live-bearing fish except that it was one of the largest of its kind, it had an enormous, cape-like top fin and its home territory was restricted to Lake Petén and vicinity in the north-central part of Guatemala.

When I went to Guatemala and adjoining British Honduras last year, I was not primarily concerned with Mollies. The purpose of the Aquarium's expedition was to obtain new and

rare races of platyfishes for our long-term experiments designed to understand better the influence of heredity in the development of black cancers. On the night preceding the date set for the first day's survey of the Lake Petén area, my guides, Señor Pinelo, the agent for the local airline at Flores, and my host Señor Castellanos, suggested a fish hunt by flashlight in the shallow waters along the lake shore.

When the spotlight was flashed in the water between the beached native dug-out canoes, I noticed a number of pale gray, ghost-like, fish-like objects. At first they were practically motionless; then gradually they began to stir in the glare of the persistent light and their shadows revealed their outlines. As they swam closer to the shore, I saw their high, sail-like fins which broke through the surface of the murky water. I realized at that instant that the fish were *Mollienisia petenensis*, a rare species only once before seen alive for a short time in the United States. I decided there and then I had to make every effort to get some of them back alive for the Society's Aquarium even though my equipment was not designed to carry fish of the Petén Mollies' generous proportions.

I would not have succeeded had it not been for the interest and help of Señors Pinelo and Castellanos in Flores, and three extraordinary persons in Guatemala City, Señor Penado, Dr. Scrimshaw and Señora Bower. With their enthusiastic cooperation, the Petén Mollies, upon their arrival in Guatemala City, were instantly transplanted into large aquaria made available especially for them and the platyfishes. The Mollies responded graciously by giving birth to a large brood of young. This unexpected bonanza facilitated my problem of how I could, in some measure, repay my friends for their kindnesses. Before returning home, I divided the lot of baby Mollies among them. The unusual fact about these babies is that ordinarily gravid Mollies, if disturbed, are not supposed to give birth to viable young. Although the Petén Mollies were carefully handled, they were nevertheless uprooted from their home and shut up in small glass jars for several days. Despite my best efforts they were jolted badly in their journey from their Lake Petén jungle home to what turned out to be their Guatemala City maternity ward. Two females and their hand-

some male reached New York City safely and continued their laudable family behavior. In our aquaria, they produced many more young, some of which were donated to British aquarists; others were given to Dr. Caryl P. Haskins who is studying their responses to related Mollies.

Mollies of one kind or another live just about in every sluggish stream and weed-entangled pool along the Atlantic coastal plain from Florida to Texas down to Mexico, the countries of Central America, Panama, Colombia and Venezuela. They are not of the same species. Neither are they radically different from one another. The aquarist can recognize the distinctive characters of a Mollie no matter where it comes from. So can the Mollies. When two Mollies from widely geographically isolated countries are brought together through the intervention of a fish fancier, the fishes respond favorably and usually interbreed. As a consequence, if the fancier takes no precautions to maintain the original natural population in separate quarters the purity of each race is threatened. The Mollies' lack of discrimination and the fancier's carelessness led to the loss of the first lot of Giant Mollies from Petén. It happened in 1935.

At that time a few Mollies from Petén were brought back alive to the United States by Dr. Carl L. Hubbs on an expedition sponsored by the University of Michigan's Museum of Zoology. They required generous living quarters for breeding and the rearing of the young. They were liberated in a pond of a commercial tropical fish breeder in Louisiana. The manager, unfortunately, failed to remove the native Louisiana Mollie, *latipinna*, from their pond. The two species interbred and the original *petenensis* was never recovered. That is, until the Society's own expedition to Lake Petén, early last year.

In our large aquaria, the spectacular Petén Mollie male was constantly displaying his enormous blue and green star-spangled top fin. He would rush out of a corner, stop short before his mate, twist his body and curve his net-like fin as if to trap her. There should have been a dozen females for him for he was entirely too energetic for the two. A glass barrier had to be placed between them, to protect them. I could not help but think that he behaved like a pugnacious rooster in a hen yard.



PICTURE NEWS FROM THE ZOO

Photographs by SAM DUNTON

As nearly as we can discover, no Callimico had been exhibited in this country until this specimen came from Peru. (Story on p. 29).

Solemn Tawny Frogmouths, closely resembling in color and markings the bark of a tree, are new arrivals from Sydney Zoo.





A pair of young Masai Giraffes is now on exhibition — first of this form in sixteen years. ➡

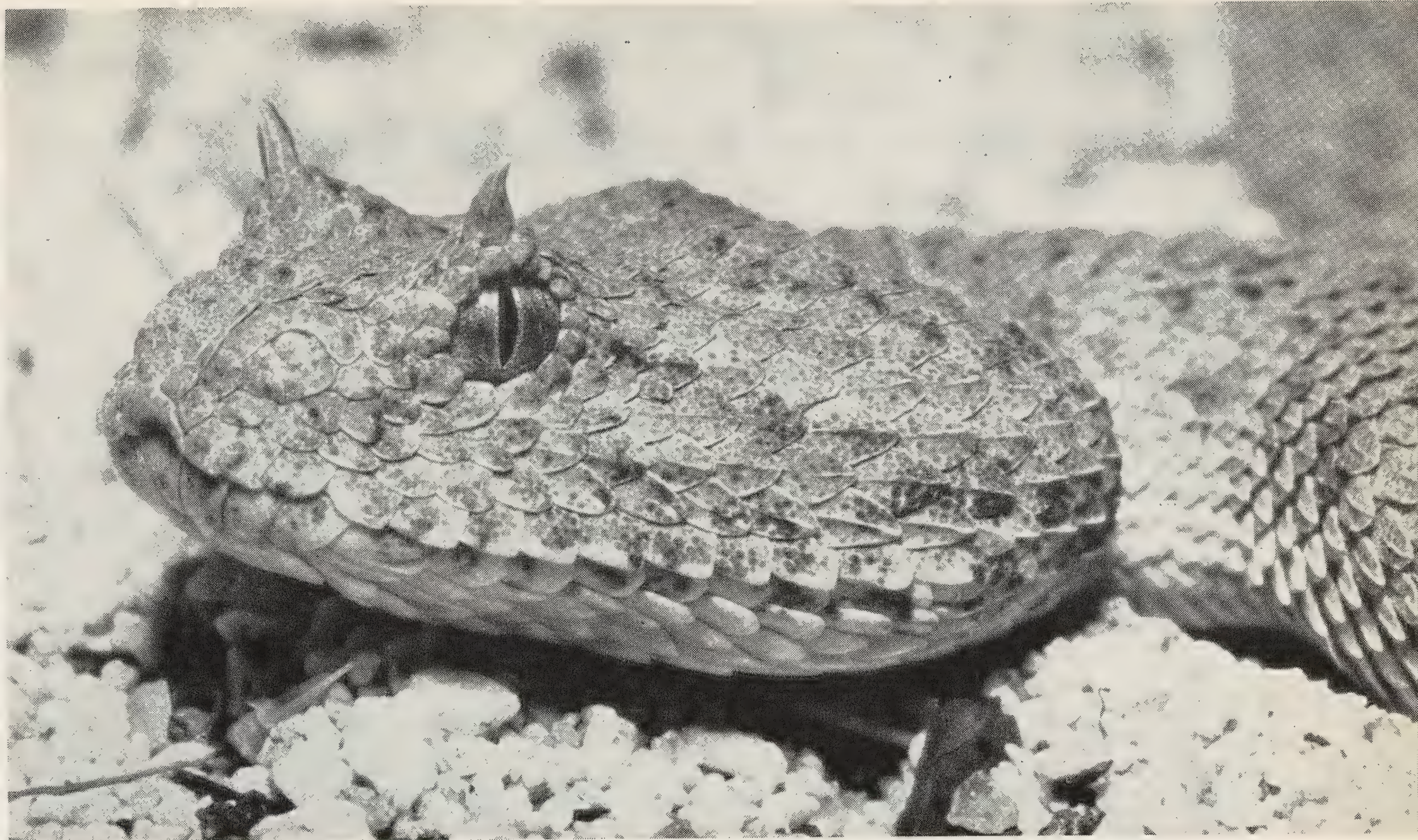
The South African Horned Viper, a desert snake, typically lies partly buried in the loose sand.

The is in when





y-scaled tail
ching motion
on the prowl.



"Horns" of the viper are formed
by single scales over the eyes.
The reptile has a potent venom.



As far as we know, these are
the first Silver Hatchet Fish
(*Thoracocharax securis*) ever
exhibited. They are true fly-
ing fish of the fresh waters
and were collected last year
probably in the Amazon basin.

These Red-backed Saki Mon-
keys were quite young on ar-
rival from French Guiana in
1953. They are adult now —
the first we have exhibited —
and the male has developed
an enormous, thick "beard."



THE ROLE OF SCIENCE is more and more a key one in resource management. Without science the fantastic scale and intensity by which this country exploits its resources would clearly be impossible. But this highly intensive use brings new problems in its wake, especially as we continue to demand ever higher levels of living. The challenge to science thus becomes even greater, given the complex ways in which an industrial society comes to depend on its resources. For resources are naturally interdependent, both physically and in an economic sense, and using one of them affects the availability of another. The use of the land, for instance, affects water supply; and pollution of water by industry affects municipal supplies, and vice versa. This theme of the interdependence of resources often appears in the research studies that the Conservation Foundation has sponsored.

Six books and three reports on resources have been published since 1948. These studies have unusual features as well as an interesting history. They have come out of research which an independent organization in this field is peculiarly fitted to undertake. And in common they embody an attitude — a point of view about the country's resources — that comes to those who work in science and who endeavor to apply it to social questions. Essentially this attitude is that if a high-paced industrial nation wants to use its resources well, it must draw steadily upon scientific understanding of resource problems. It is the spreading of this understanding at which our books aim.

That we must look to science may be obvious to the reader. Yet it may surprise him to discover how little is actually known about some resources that have been used since time out of mind. Parts of our studies, in fact, recommending investigations which should be pursued, read like almanacs of ignorance.

This is another theme illustrated in these research reports: that ignorance still prevents efficient use and conservation; resources are used badly because we do not yet know how to do better. And further that, if the knowledge exists, it is often not, for one reason or another, put into practice.

Hence the germ of many of our research studies was a question, or series of questions,

ALL ON THE THEME OF CONSERVATION

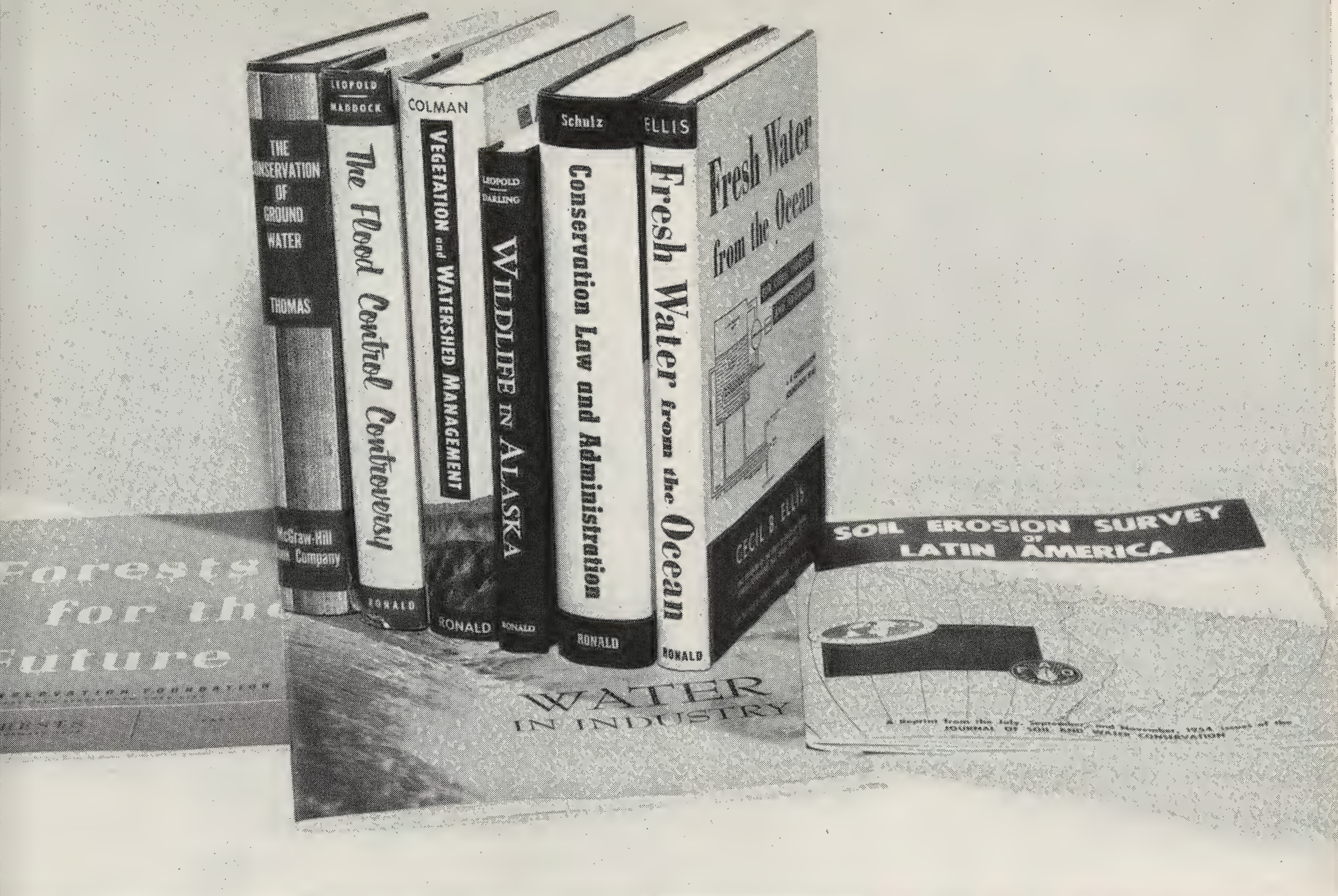
By **STEPHEN W. BERGEN**

Assistant, Research Division, The Conservation Foundation

about the state of knowledge in a particular field and its present degree of application. In several instances a project essentially entailed bringing the findings of many sciences to bear on a specific practical problem, such as the study of flood control methods and policies.

No fewer than five of the Foundation's studies deal with some aspect of water supply and development. Over the last decade or so there has been a great permanent increase in the nation's over-all water needs, and many existing water supply measures and facilities are proving to be extremely inadequate.

Our first water project surveyed the present ground-water situation in the United States and brought together from many sources information on ground-water use over the country, thus making generally available the experience gained and management practices applied in various areas. The study was successfully published commercially as "The Conservation of Ground Water," and a number of universities are now using it as a text. Its value lies in its broad, nationwide appraisal of where we stand with respect to this



water source and in its specific recommendations for further development and research.

"Vegetation and Watershed Management" is the title of our second book dealing with water. "Managing" the vegetation of forest and wild lands and of croplands, specifically to improve the way water comes off the land, is a promising method of water control and erosion prevention. But experience is limited, and many aspects that are now controversial require much more research. This book places present knowledge of vegetation management in perspective by showing what else must be learned before particular methods can be widely applied.

In these two studies we were advised by special committees of scientists from universities and from governmental agencies, in order to have the benefit of varying backgrounds and viewpoints. This is one advantage of the independent organization in the resource field — that it may readily bring together specialists in several disciplines.

A third book, "Fresh Water from the Ocean," is a technical evaluation of the possibility of

These books and pamphlets have come out of research fostered by the Conservation Foundation since 1948, and are widely distributed.

purifying sea water on a large scale at low cost. The great benefits a successful cheap method would bring to the world's arid areas continue to stimulate work and discussion. This systematic examination of the basic physics of the conversion problem is designed to encourage further fruitful research.

Only since World War II are industrial water needs and use beginning to get attention on a scale their magnitude and complexity demand. In 1950 our staff cooperated with the National Association of Manufacturers in a broad survey of the use of water in 3,000 representative industrial plants. This study, published as "Water in Industry," has had a large industrial distribution and has been widely used by engineers and planning agencies.

Our most recent project concerned with water resources deals with the nation's flood control programs and policies and analyzes current con-

troversial questions in this field. Carried out with the cooperation of the U. S. Department of Agriculture and the Corps of Engineers, U. S. Army, "The Flood Control Controversy" is the only description generally available of how Federal flood control measures are justified and planned. It summarizes the relative merits — and limitations — of both big and small dams, and also how much and when land management may control flooding. There is a continuing demand for flood control work in many parts of the country. This book may well have a strong influence in clarifying for the general public the nature of the problem and the methods available to deal with it.

The major study in wildlife conservation so far sponsored by the Foundation is "Wildlife in Alaska," the record of an extended journey of observation in the Territory in the summer of 1952. This was "an ecological reconnaissance" which covered especially Alaska's invaluable wildlife resources — particularly Caribou, Moose and Reindeer. The impact of human settlement on wildlife habitats is analyzed and set against the work and research still to be done to secure sound management of these animal resources, which are of key importance to many who live in Alaska. Various Federal and Territorial agencies aided the authors in the field; the study was sponsored jointly with the New York Zoological Society and the University of Alaska.

"Forests for the Future" summarizes varying controversial interpretations of the national forest situation. At present there is strong disagreement on two major issues: the *rate* at which the forests of the United States are being depleted, and the wisdom of proposals that have been made for governmental regulations to check depletion and increase productivity. This pamphlet is designed to increase public understanding of the problems confronting the makers of policy at this stage in American forestry, by presenting the views of different groups along with the facts with which all agree.

Laws, as well as the current state of science, affect the way resources are used. "Conservation Law and Administration" is a case study of law and resource use in the State of Pennsylvania, and surveys the statutes and administrative agencies and practices that regulate or influence re-

source utilization in the Commonwealth. It was carried out by the Law School of the University of Pittsburgh. The specific resources covered are fish and game, water, forests, recreation areas and agricultural land, and there is also a section on conservation education. Because of its complex association of industry, commerce and agriculture, Pennsylvania is an ideal laboratory for the study of the legal and governmental questions arising from efforts to achieve the intelligent use of resources. Hence this book should prove extremely useful to residents of other States as well. It includes a draft of model State legislation for efficient and integrated administration of renewable resources.

Our most recent research publication, sponsored jointly by the Foundation and the Food and Agriculture Organization of the United Nations, is a regional map-survey called "Soil Erosion Survey of Latin America." Three maps, covering the Americas south of the Rio Grande on a scale of 1:10,000,000, with trilingual legends, are accompanied by a descriptive text that emphasizes the causes of erosion in the several countries. Remedial measures — technical, economic and administrative — are also suggested. We are arranging for wide distribution of this study to key persons in science, government, and universities in the countries concerned, in the hope that it will assist in plans for coping with this major problem.

For all these books and pamphlet reports we have had very much in mind the need to promote them actively — to make sure that they are put to use. Plans for reaching the potential market in each case are laid at the same time as research begins. Upon publication, scientists at universities and in industry, members of professional societies and other groups are informed of the bearing of each report on present resource questions. Naturally many of the intimate connections our organization has established with these persons and organizations stand us in good stead in this highly essential promotional work.

The distribution of our publications to date has been very gratifying. More important, perhaps, is the fact that they are gaining a reputation for objectivity and realism — not a small achievement in a field charged with emotion, dogmatic attitudes and politics.



The Adaptable Wren

By EDWARD A. ARMSTRONG

*Author of Bird Display, Birds of the
Grey Wind, Bird Display & Behaviour, etc.*

vided the clue we needed, for we knew it must come from where Wrens are numerous in the deserted village, near which was the only place a boat could put in safely.

Here, and on other island groups around the British coast — and indeed also on the islands of

A European Wren has just alighted on a tangle of vines in which its nest has been built. The chick's open mouth is beyond the Wren's beak.

All photographs by the Author

THERE CAN BE FEW BIRDS more fascinating than the diminutive Wren — the Winter Wren, as it is called in North America. Almost every aspect of its behavior is peculiar. It is not surprising that in Europe this tiny bird has been the central figure in fables and odd ceremonies from time immemorial. If the story of the Wren outwitting and outflying the eagle is pure fiction, it is sober fact that Wrens flew to islands, such as the Pribilofs and Formosa, and established themselves there.

Not very long ago as time is reckoned by geologists, the pioneers of the species crossed a land-bridge at Bering Strait and their descendants wandered right across the temperate regions of Asia to the westernmost islands of Europe. I have found Wrens in Irish woods, on the slopes of snow-topped mountains in Iceland and in Algerian ravines. One of my most vivid memories is of Wren songs ringing out at misty daybreak as our small boat lay off the cliffs of St. Kilda, fifty miles out in the Atlantic. The bright chorus pro-

the North Pacific — Wrens have been established sufficiently long to have developed characteristics entitling them to be ranked as subspecies. Going south in America we find many different kinds of Wrens, especially when we reach the tropics, and we may therefore assume that in this area the family originated, and from it the birds spread, becoming modified in the course of many centuries as they adapted themselves to different types of environment. The Wren has not colonized the tropics, but it has girdled the globe.

Far from being a disadvantage, the Wren's small size aided its invasion of Europe and Asia, for in these continents there was no species already established which could, like the Wren, find food by creeping into very thick undergrowth and tiny crevices. Nor does its tinyness prevent its making great journeys. Although only in the most northerly areas of its range does the Wren migrate regularly, yet, even where it is resident all year 'round, individuals may make immense journeys. For example, a bird ringed on

an island in the Baltic was recovered in northern Italy.

In Europe, and even more in North America, where the Wren, unable to compete with the House Wren for niches near houses, keeps mainly to the woods, it is more frequently heard than seen. Lord Grey told an apt anecdote of a schoolboy who complained that he was interrupted in doing his lessons by "that shattering Wren." This powerful and persistent song is uttered by the male to warn off rivals from his comparatively large territory and to attract females. As we shall see, he may induce more than one to join him.

As if to offset the lack of brilliant adornments with which some birds are endowed, and which they use to defy other males or to impress females, Wrens have evolved song into a highly expressive language. The cock can alter his customary phrase to a strident, congested version, when challenging an intruder, but when wooing a female he modifies his song to a subdued, sweet trickle of sound. On hearing this melodious warbling one is inclined to murmur, with Shakespeare, "How silver-sweet sound lovers' tongues." It is easy to tell when a female has entered a male's domain, for if you hear this soft strain as you approach, you may confidently infer that the Wrens are courting.

The female is coy and quiet, creeping mouse-like amidst the herbage, and she utters a song in keeping with her shy ways. It is audible no more than a few yards away. Occasionally she engages in this soft twittering as she sits on the eggs, but more often she sings her shadow-song when she is concerned about her family. She may whisper it when she arrives with a tidbit at the nest, apparently to attract the chicks' attention, or when feeding them after they have fledged. Once I watched a female leading her family from the nest. She crept up a sloping, ivy-wreathed bough, twittering her simple ditty, and after her, in single file, came hopping along her six youngsters. The little procession reminded me of the Seven Dwarfs in Walt Disney's film. Even more delightful scenes occur when the youngsters are being put to bed. They are led to another nest, sometimes one of the male's auxiliary nests, but often the open nest of some other bird, and one by one, after fussing around and



some show of reluctance on the part of the chicks, they hop in. When they are all safely ensconced their mother emerges and, perching for a few moments on a twig close to the dormitory, contentedly sings her subdued lullaby. Then she goes off to feed and seek her lonely roost elsewhere in the wood. I have roamed jungles in Asia and Central America without seeing a prettier sight.

In nest-building craftsmanship the Wren is an expert and is able to adapt his behavior to circumstances to a remarkable degree. Few birds build in more varied sites. I have seen nests 30 feet high in trees and others in the ground. On treeless islands the Wren is content with nooks under overhanging turf or crevices in high cliffs.

If moss and leaves are lacking the Wren can "make do" with other building materials — dry grass or even seaweed. There is a record of a nest built of Emu feathers — where these birds were kept in a paddock in England. So cunningly are the pieces of material compacted that some naturalists have suggested that the Wren sticks them together with saliva. The fact is that the bird builds with damp material which bonds as it dries. Knowledge of this peculiarity makes the difficult task of finding Wrens' nests easier. I have often said to myself, "Here's a wet day. I'll go and see where the Wrens are building." As Wrens may construct up to a dozen nests in a season, many of them well concealed, this clue is useful. Very few other European birds build covered nests of vegetable material and there is evidence that the ancestors of some of them, like the Wren's ancestors, came from the tropics.

How are we to explain the Wren's expenditure of energy in making so many nests? Probably only about half of them ever contain eggs. These "cock's nests" are called "play-nests" in Germany, and for many years it was supposed that they were useless. The reverse is true. They have a function in the mating affairs of the Wren and are used as dormitories by the fledged young. At any season of the year adults may roost in them

A typical haunt of the Shetland Wren. Food is relatively scarce here, and the males are mainly monogamous, helping in feeding.

The Shetland Wren itself — a trim, tiny creature notable for its stout legs and bill. This form is confined to the Shetlands.

but in winter their principal use is as communal refuges during bad weather.

Normally the male builds and shows his handiwork to any female who joins him. The procedure is very interesting. Finding a stranger on his beat the male sings and displays; thereupon another male sings in reply or retreats, but a female makes herself known as such by being coy. Now he dances attendance on her, singing soft, melodious snatches, vibrating his drooped wings and, occasionally, chasing and pouncing play-

fully on her. One morning, if you are fortunate, you may see him singing excitedly as he goes from perch to perch while she follows diffidently. When he arrives at the nest he stands on a twig before the entrance, singing his sweetest love-lilts, and quivering his wings like a brown cloak around him. Suddenly he darts into the nest, thus indicating where the aperture is to be found. He soon reappears, continuing to sing and display while his inamorata creeps closer, seemingly interested only in the spiders and insects in the undergrowth but actually alert to all that is happening. She teeters to the entrance, cranes her neck to peep in — and hops inside to inspect the accommodation. The male, unable to contain his excitement, may also go in and show her around. If, after she has viewed the prospective dwelling, no defect is apparent, she lines it with feathers.

There can be no doubt that the efficiency and vigor of the male are important in enabling him to secure mates. After installing a partner in a nest a cock Wren continues endeavoring to attract other females. Thus, if one or two nests are already occupied an uxorious male needs to have at least one other available for vacant possession, should another female be induced to join him.

But are polygamous males more successful than those which secure but one mate? If a female is left to do all the work while her mate is seeking or courting other females, only about half as much food is brought to the nest as when the



male helps; and if, in consequence, some of the nestlings die or fledge in an under-nourished condition, the more domesticated, monogamous males might leave more sturdy progeny to bring up families in their turn than the polygamists.

The Wren solves this problem in a remarkable way. Where food is relatively scarce, as on bleak islands such as Shetland and St. Kilda, the males are mainly monogamous and help to feed the nestlings. In areas such as southern England, where prey is more abundant, a single Wren can bring up five or six young unaided. Here polygamy is commonest. Parallels may be found in human society! In communities among which polygamy is approved it is usually most prevalent among the wealthier classes.

Thus Wrens' marriage relations are adjusted to the character of their surroundings. But adaptation goes still further. In spite of his polygamous tendencies the cock may, if necessary, help to bring up the brood, and will even undertake entire care of the nestlings from about the age of a week. If a female is killed or deserts the family a male's behavior may undergo an extraordinary transformation. Instead of paying a casual visit to the nest now and then he works furiously — and thus may save the situation. To all outward appearances he becomes a female — no longer singing, courting or nest-building, but concentrating entirely on ministering to the needs of the family.

How exactly is this change brought about? To imagine that a bird can realize that disaster will befall the family unless it works particularly hard is to attribute to it human modes of thought. There is no need to suppose that a Wren can foresee the future in this way. The male's additional efforts in a crisis may be explained quite simply. Nestlings which are not receiving sufficient food, call and beg with accentuated vehemence. This stimulates the parent to work harder. Thus the demands of the young bring about an increased supply.

Actually, of course, the rate at which the nestlings are fed is not simply a matter of supply and demand. It is closely bound up with the vigor of the parent. If detailed observations are made of the tempo of visits to the nest with food, we find that about every four hours during the working day a Wren is particularly diligent. Then

the rate of visits falls off for about two hours, when it again begins to increase. It seems that the bird is so constituted that its output of energy waxes and wanes according to a "short-wave" rhythm.

Among Wrens adaptability is not confined to one sex. Not only may the male adopt the role of the female but the female may behave like a male, to the extent that she may help to build nests. The female may even work harder than her mate on nest-construction. I have seen a cock Wren so bewildered by his mate's energetic nest-building that he often dropped the materials he brought and went off muttering disjointed snatches of song.

Thus we have the interesting situation that, although among Wrens more than many other species, each sex tends to specialize in certain activities connected with breeding, yet, in cases of necessity, either sex can undertake some of the duties of the other. Such adaptability must have been of immense value to the species during its invasion of Asia and Europe.

When winter comes the Wren's song and nest serve other purposes than in spring. Instead of being a proclamation of defiance and an invitation to unattached females, the Wren's song becomes an assembly call. At dusk on frosty evenings calls and songs are heard in the woods and little parties of Wrens may be seen searching for a snug roost. Probably males take it in turn to lead the way to nests in which families were not reared in spring, or to other suitable nooks. The nests occupied by families are usually too dilapidated by the autumn to be used as dormitories and the auxiliary nests offer comfortable quarters. If severe weather prevails for a long time the number of Wrens may increase nightly until accommodation is taxed to the utmost. More than forty Wrens have been found crowded tightly into a nesting-box. While the snow drifts softly down on the branches outside or the gale screams through the trees, the Wrens crouch in gently heaving layers on top of one another. So at least some of them manage to survive until milder weather prevails. Then the cheerful songs are heard once more and, with tails cocked over their backs, they shout defiance far and wide — delighting all who take pleasure in the queer ways of little birds.

Gecko

THE CHIRPING REPTILE

By JAMES A. OLIVER



REPTILES AS A GROUP are relatively quiet, seldom given to disturbing the peace with raucous vocalizations. This statement is true for the group as a whole, although exceptions come readily to mind. The rattling of rattlesnakes and the hissing of many reptiles can scarcely be included among the exceptions since they are relatively subdued sounds made only when the animal is excited. Turtles do little more than wheeze, hiss or give vent to somewhat prolonged grunts. The bellowing of crocodilians, particularly that of the Alligator, is a forceful and well-founded exception, as is the croaking cry of the Tuatara. To inhabitants of the warm tropical and subtropical regions, geckos are well-known reptilian vocalists — loudly proclaimed exceptions to our introductory generalization.

Even the name of this group of lizards is based

The Tokay Gecko of the Indo-Malayan region. It reaches a length of about 13 inches; ours is a nine-inch specimen. The alert pose is typical.

on an effort to imitate the outbursts of one species. The term “gecko” is applied as a general designation for all lizards of the family Gekkonidae. This is an ancient, widely distributed, structurally diverse and fascinating group of reptiles. The family has representatives on all continents except Antarctica and on most islands of the warm seas. An estimated 700 species make up the family, and they range in size from two inches to more than a foot in total length. The most trenchant attributes of the family are skeletal, but two external characters common to virtually all of the species are expanded fingers and toes and elliptical pupils in the eyes.



Details of the under side of the hind foot of the Tokay Gecko, showing the broad scales, or lamellae, and the claws. Both the scales and the claws aid in climbing on smooth surfaces.

The digits are expanded in different fashion in the various groups. In some the entire digit is expanded, in others only the basal portion or only the tip may be enlarged. The broad scales, called lamellae, on the under surface of the digits are either divided into pairs or are single. The expanded areas serve as adhesive organs that enable geckos to climb smooth surfaces with ease — even to scamper across the ceiling of a house. Originally it was believed that the digits functioned like suction cups. However, the detailed studies of Beni Charan Mahendra and others have shown that suction plays no part in the function of the digits. Most geckos have claws at the end of the digits and these are extremely thin and sharply pointed. The exposed surface of each lamella is made up of a vast number of microscopic projections that are recurved at the tip. The claws and the minute projections are inserted into minute irregularities of the surface on which the animal is walking. By a process of

interlocking of the tiny projections, the foot adheres securely to the surface. With such secure footing geckos race up walls, window panes and other seemingly smooth surfaces. A few species are ground dwellers and lack expanded digits and are sometimes clawless.

Most geckos are nocturnal in habits, becoming active around dusk and continuing their capers during the hours of darkness. The elliptical pupil of the eye is a structure commonly found in nocturnal animals. Actually it is an effective device for protecting the internal light-sensitive cells of the retina from bright daylight. At night when there is little light the pupil expands, becoming much enlarged and nearly circular. Under these conditions the eye is able to record objects seen in very dim light. If a bright light is shined on the eye at this time, the pupil quickly contracts to prevent the strong light from falling on the retina. Staff Photographer Duntton's excellent photographs accompanying this article show the pupil of a large Tokay Gecko in bright light and as it appears in darkness. The latter condition was photographed by means of infra-red light and shows the angular outline of the expanded pupil.

To return to the vocal attributes of geckos, many species have loud, sharp, chirping or clucking calls, some of which can be heard for a distance of a hundred yards. The calls play a part in the social life of these lizards, aiding them in maintaining territorial limits, in courtship activities and in warning intruders or enemies. The calls of different species vary considerably and often serve as a basis for the common name. Thus the largest of the geckos is called the Tokay Gecko because it has a call variously described as "tokay," "tuk-kaa" or "tuck-too." Malcolm Smith, an outstanding British herpetologist who has contributed so greatly to our knowledge of Indo-Australian reptiles, writes of the Tokay as follows:

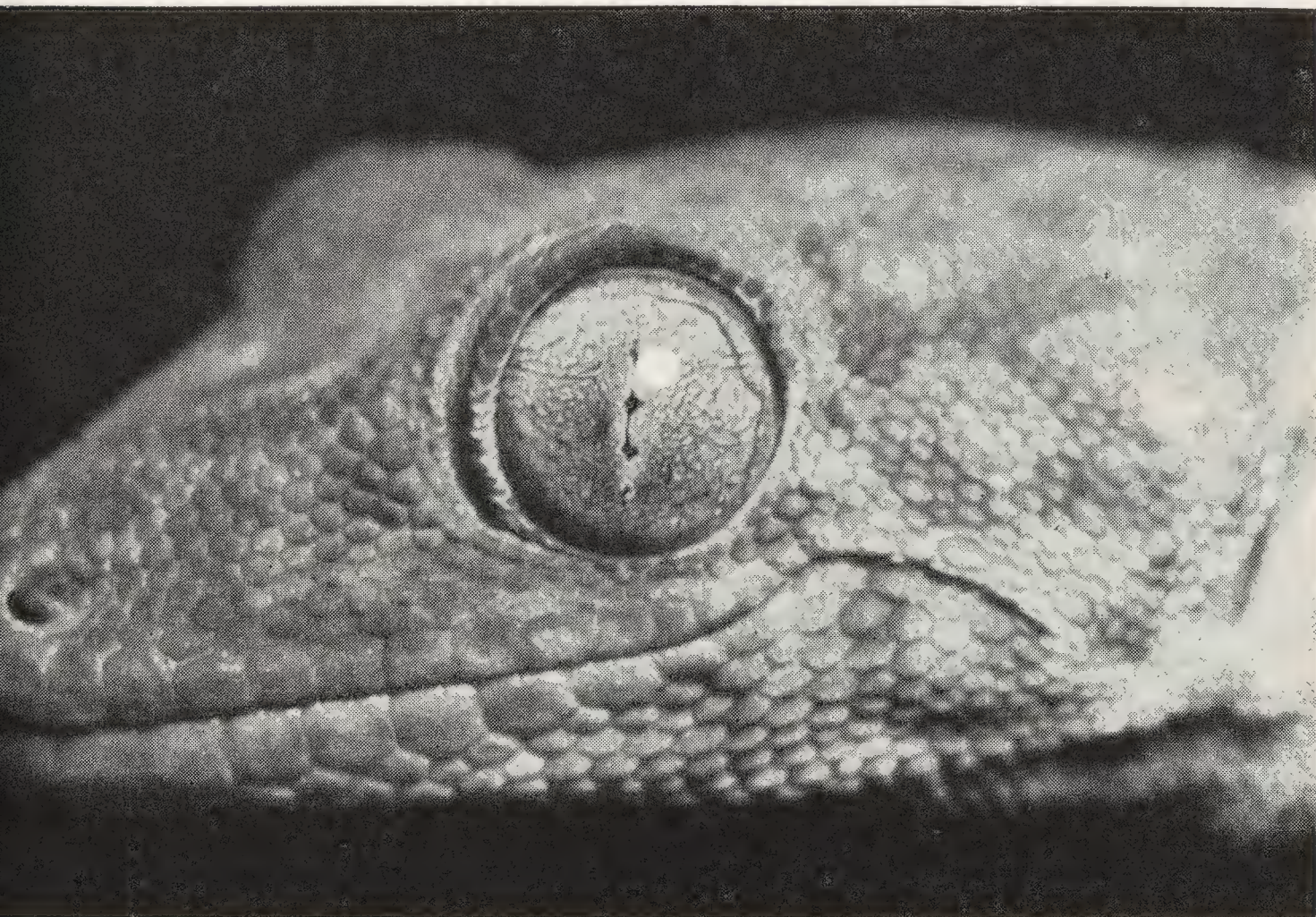
"Each call consists of a preliminary cackle, then the sound 'tuk-kaa' repeated deliberately and distinctly several times, finally capped by a low gurgle. The calling is not continued throughout the whole year. It commences about the middle of cool weather (December), becomes more frequent as the hot weather approaches, and is at its maximum during March, April and May.

During these months they can be heard calling frequently, sometimes all through the night, one lizard after another taking up the cry from house to house. After these months they call less frequently, and during the autumn are usually silent."

This gecko attains a maximum length of 13 inches or more and occurs from India eastward through the East Indies and the Malay region to southern China and Indo-China. A handsomely colored nine-inch adult in our reptile collection is shown in the accompanying photograph. When disturbed, this gecko opens its mouth widely, rushes at the intruder and makes an ex-

plosive rolling cluck. Its powerful jaws and sharp teeth are capable of inflicting a painful but not serious bite.

Because they feed chiefly on insects, these lizards are usually welcomed into the homes of residents of the tropics. Arthur Loveridge, the noted herpetologist of Harvard's Museum of Comparative Zoology, tells us that in some districts where the Tokay Gecko occurs the occupants of a new house anxiously await the arrival of the first gecko, "venturing to predict something of their own future fortunes from the number of days that elapse before its appearance. Apparently the sooner it comes, the better are



The eye of the Tokay in daylight with the pupil contracted until very little illumination falls on the light-sensitive retina.

Photographed in darkness by infra-red light, the pupil opens in the shape of a polygon, like the shutter of a cheap camera.



their prospects. Similarly it is a good omen for a Tokay to call at the birth of a child; the oftener its cry is repeated, the better for the baby."

But geckos are not always welcomed so warmly and there are numerous superstitions treating them as evil and venomous creatures. Throughout most of the American tropics these lizards are believed to be highly venomous. The belief is that the expanded portions of the digits contain venom glands. In some regions it is believed that when a gecko walks on a sleeping person the "victim" will acquire leprosy, or at least, break out with painful blisters wherever the toes touched. Sometimes these lizards are feared more than venomous snakes. Actually none are venomous and they are all completely harmless, except for the largest species which can only inflict a slightly painful nip. Fortunately these superstitions are dying out and the

geckos are becoming more and more appreciated as interesting, beneficial and frequently entertaining animals.

In his *Sketches of the Natural History of Ceylon*, J. E. Tennent relates the following tale about one of the large geckos:

"In an officer's quarters in the fort of Colombo, a gecko had been taught to come daily to the dinner-table, and always made its appearance along with the dessert. The family was absent for some months, during which the house underwent extensive repairs, the roof having been raised, the walls stuccoed, and the ceilings whitened. It was naturally surmised that so long a suspension of its accustomed habits would have led to the disappearance of the little lizard; but on the return of its old friends, it made its entrance as usual at their first dinner the instant the cloth was removed."

News from the Conservation Foundation

Changing Earth

Messrs. Osborn and Ordway have been invited to participate in the Wenner-Gren Foundation international conference to be held June 16 to 22 at Princeton University. The conference will treat of "Man's Role in Changing the Face of the Earth," and Mr. Ordway has been invited to deliver a paper on "Possible Limits of Essential Raw Material Consumption."

Summary Description

A brief description of the purposes, organization and activities of the Conservation Foundation has just been published for public distribution. This booklet is also available from the Foundation.

Historical Study Completed

"A History and Projection of Population Growth in Jamaica" is the subject of a year's review of Jamaican demography by George W. Roberts of the British Development and Welfare Organization at Barbados.

Watersheds and Forests

The Conservation Foundation was a co-sponsor of the American Watershed Congress, held in Washington in December. Mr. Osborn served as Chairman of the opening session.

The Foundation among others has been invited to review the new Forest Resource Resurvey to be issued by the U. S. Forest Service.

Geographical Conference

Vice-president George Brewer and Mr. Peter Stern of the Conservation Foundation staff participated in a formal conference of geographers held at Yale University early in January. The conference considered methods of expanding the teaching of geography, with particular emphasis on the relation of life to environment.

Food and Immigration

The British Committee on Political and Economic Planning is about to publish an analytical paper, under the joint authorship of President Fairfield Osborn and Professor Kingsley Davis of

Columbia University, on the limits of the ability of the United States to feed undernourished and overpopulated areas of the world, and our capacity to absorb substantially more immigrants. Copies of this paper are available from the Conservation Foundation.

Education Films

Distribution of the new Junior Conservation Series of motion pictures, "Your Friend the Water," "Your Friend the Soil" and "Your Friend the Forest," has been launched by Encyclopaedia Britannica Films, Inc.

A 35 mm. version of the "Making of the River" has been completed and we are hoping for theatrical release in New York City and elsewhere. Coronet Films on January 1 released the 16 mm. version both in black and white and in color.

Editorial Appointment

Vice-president Robert Snider, in charge of research for the Conservation Foundation, has been appointed to the Editorial Board of the *Journal of Soil and Water Conservation* published by the Soil Conservation Society of America.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Election of Two Fellows and a Photographic Consultant

The Zoological Society is pleased to announce the election of two Fellows and a Photographic Consultant. Dr. Sophie Jakowska, Assistant Professor of Biology at the College of Mount St. Vincent, and Dr. Aubrey Gorbman, Chairman of the Department of Zoology of Barnard College, have been made Fellows in recognition of their scientific work in association with the Society, and Henry M. Lester, a specialist in high-speed photography who has been working on technical details of our motion picture program, has been named Photographic Consultant.

Zoological Park Miscellany

The distinction of being the first baby of the new year goes to a Nyala, born on January 2. Three other Nyalas, an Angola Colobus Monkey and a Blue Duiker hybrid were end-of-the-year arrivals. . . . A Gray Seal, new to our collection, has been received as a gift of Dr. T. W. M. Cameron of McGill University. It was captured as a pup just a year ago, and has settled down well in our Harbor Seal Pool. In fact, it is so much at home that we have to take precautions to insure that the little Harbor Seal gets enough to eat. — W.Br.

We Have a Callimico, but Is It a Marmoset or a Monkey?

On December 19 the Mammal Department was interested to receive a small black primate that purportedly had been captured some weeks before in the upper reaches of the Amazon, near Iquitos, Peru. This little black animal was, to the best of our knowledge, the first specimen received by a North American zoological park — the first specimen, indeed, that we had ever seen either living or dead — of the Callimico, or Goeldi's "Marmoset," *Callimico goeldii* (Thomas). (PICTURE ON PAGE 15).

The Callimico, which looks like a marmoset but really isn't one, has been the object of speculation and controversy as to its proper classification ever since it was originally described. This state of affairs has existed because the Callimico is peculiarly intermediary between the families of New World monkeys (Cebidae), and the marmosets (Callitrichidae), possessing some of the characteristics of each family. Externally, its facial aspect, foot structure and claw-like nails ally it to the marmosets. On the other hand, its dental formula, skull configuration and convolvent or upward-whirling tail show its relationship to the New World monkeys. To this day, mammalogists do not agree as to whether the Calli-

mico should be grouped with the Cebidae or the Callitrichidae.

The first specimen ever to come to notice was one in the Zoological Gardens connected with the Pará Museum in Brazil. This animal was incorrectly identified by the Brazilian zoologist Goeldi as an aged specimen of Weddel's Marmoset, *Midas weddellii* (Deville). Oldfield Thomas, the famous British zoologist, recognized it as a new species, however. He described it under the name *Midas goeldii*, considering it a hitherto undescribed marmoset.

In 1911 another specimen, a female living in the same Zoological Gardens at Pará, was described by Professor Miranda Ribeiro as a new genus and species, *Callimico snethlageri*. He correctly considered it to be an intermediate form between the Titi Monkeys (*Callicebus*) and certain marmosets (*Mico*). By putting these two generic names together, he coined the new generic name *Callimico*, which was recognized as valid. Ribeiro was incorrect, however, in calling the animal a new species, for Oldfield Thomas recognized it as identical to the *Midas goeldii* that he had described seven years earlier. The specific name *goeldii* took precedence, and the *Callimico* finally was known by its proper scientific name, *Callimico goeldii*.

Very little concerning the natural history of the *Callimico* is known. The few specimens known to science have been taken in the region of the headwaters of the Amazon River, mainly in western Brazil and eastern Peru. It presumably is quite similar to the marmosets in its habits.

Adult specimens are described as being brownish-black in coloring, with two or three light buff-colored rings on the upper part of the tail and buffy markings on the nape of the neck. The young lack the light tail rings.

Our specimen, a young male, has no trace of tail rings, its fur being almost uniformly brownish-black. However, much of the hair on its nape and back is tipped with buff. The skin of its face is almost black, and the bare skin of its hands and feet are a sooty gray color in contrast to the skin on the rest of its body, which is a light flesh color.

Our *Callimico* chirps and twitters like a marmoset, and is being given a marmoset diet in captivity. It is quite fond of American chameleons

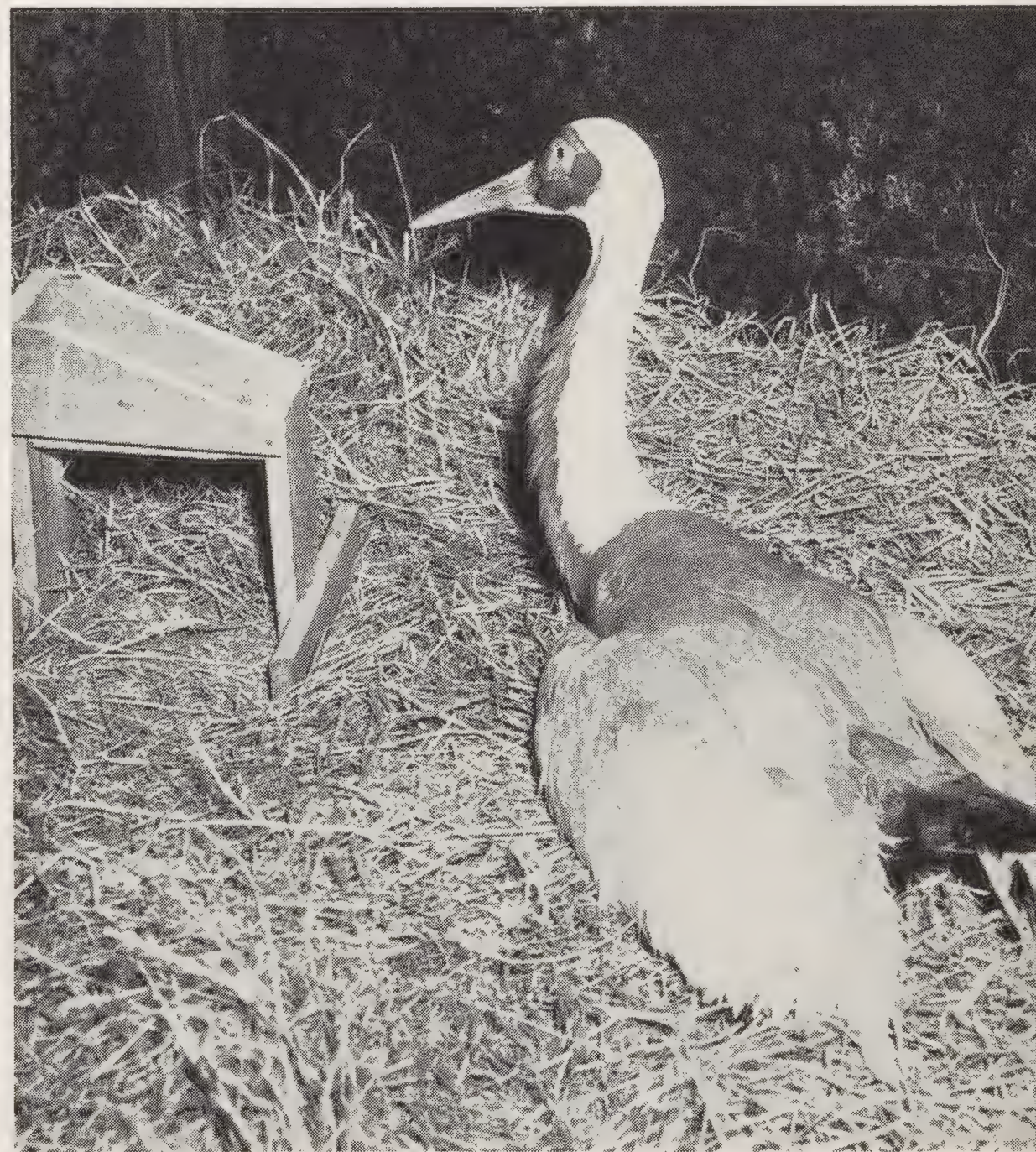
and very likely feeds on small lizards and insects in the wild, as well as on various fruits and seeds. — R.M.McC.

Nothing Fancy — But the Crane Is Able to Walk Again

The crudest kind of sling — an old burlap bag and some cord — seems to have worked wonders with a White-necked Crane in our collection.

On November 29 Keeper Bell of the Aquatic Bird House reported that the crane was extremely weak, unwilling to eat and unable to stand. It was obviously suffering from a severe respiratory infection, and was removed to the Animal Hospital and placed on a schedule of intravenous feeding with daily injections of an antibiotic.

Improvement was rapid in the next few days and the respiratory infection was overcome, but the bird still lacked the use of its legs. Under Assistant Veterinarian Gandal's direction, Hospital Attendant Waltz rigged up a sling to suspend the crane so it could exercise its legs. Three times a day, for half-hour periods, the bird "stood" in the sling and after two weeks was able to stand alone. The following day it was able to walk about its cage, and early in January it was



The White-necked Crane couldn't get up.

considered completely recovered and was discharged from the Hospital. — W.BR.

In Dull Times Between Murders — Relax at the Bronx Zoo!

Besides serving as a place of relaxation for flesh-and-blood New Yorkers, the Bronx Zoo on occasion performs that function for fictional characters. In "Vamp Till Ready" by Terry Rieman, published by Harpers, a tense moment in the life of the murder mystery's heroine is relieved by a visit to the Bronx Zoo.

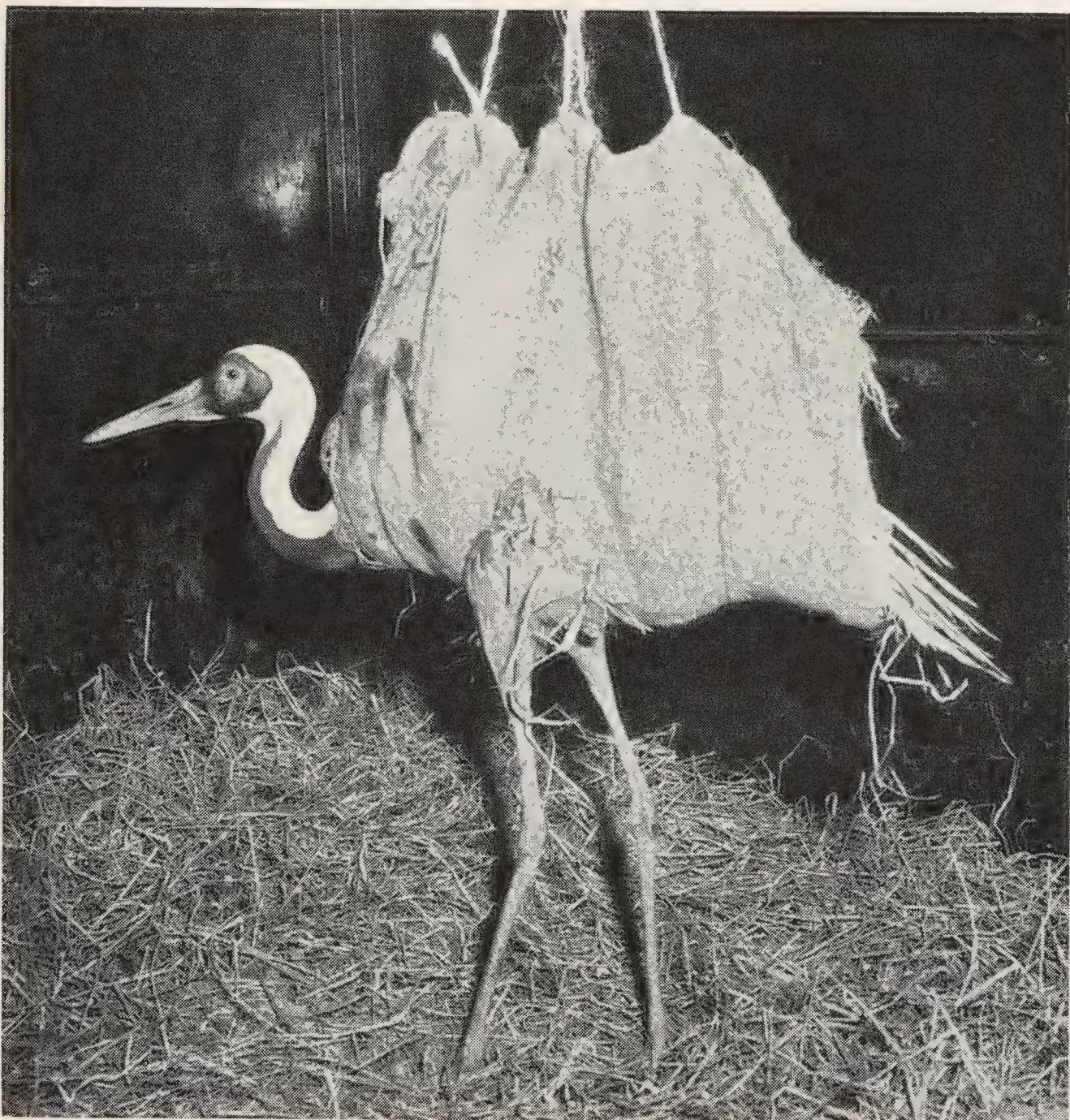
"And the atmosphere at the zoo, when Nicky and I got there, was much nicer than that surrounding lunch. It was cool and crisp and sunshiny, with squirrels, fat and sleek, playing everywhere and all of the animal-food vending machines working for once. [Internal evidence that the author *has* visited the Zoo, more than once, for the animal-food vending machines do sometimes run out of food!]. There was a new penguin house to be admired and a new baby elephant who blew at me indignantly when I ran out of food for her. There were two baby tigers, with paws the size of soup plates, still coated with fluffy kitten fur, who felt playful. And the spectacle of a great and glowing tiger, surely the most magnificent animal in the world, stretching himself up the bars of his cage like an affectionate tabby against a leg, so that the diminutive Mrs. Martini who had raised him from a cub could scratch his tummy while he purred an enormous sound, which was one I shall never forget."

PUBLICATIONS OF INTEREST

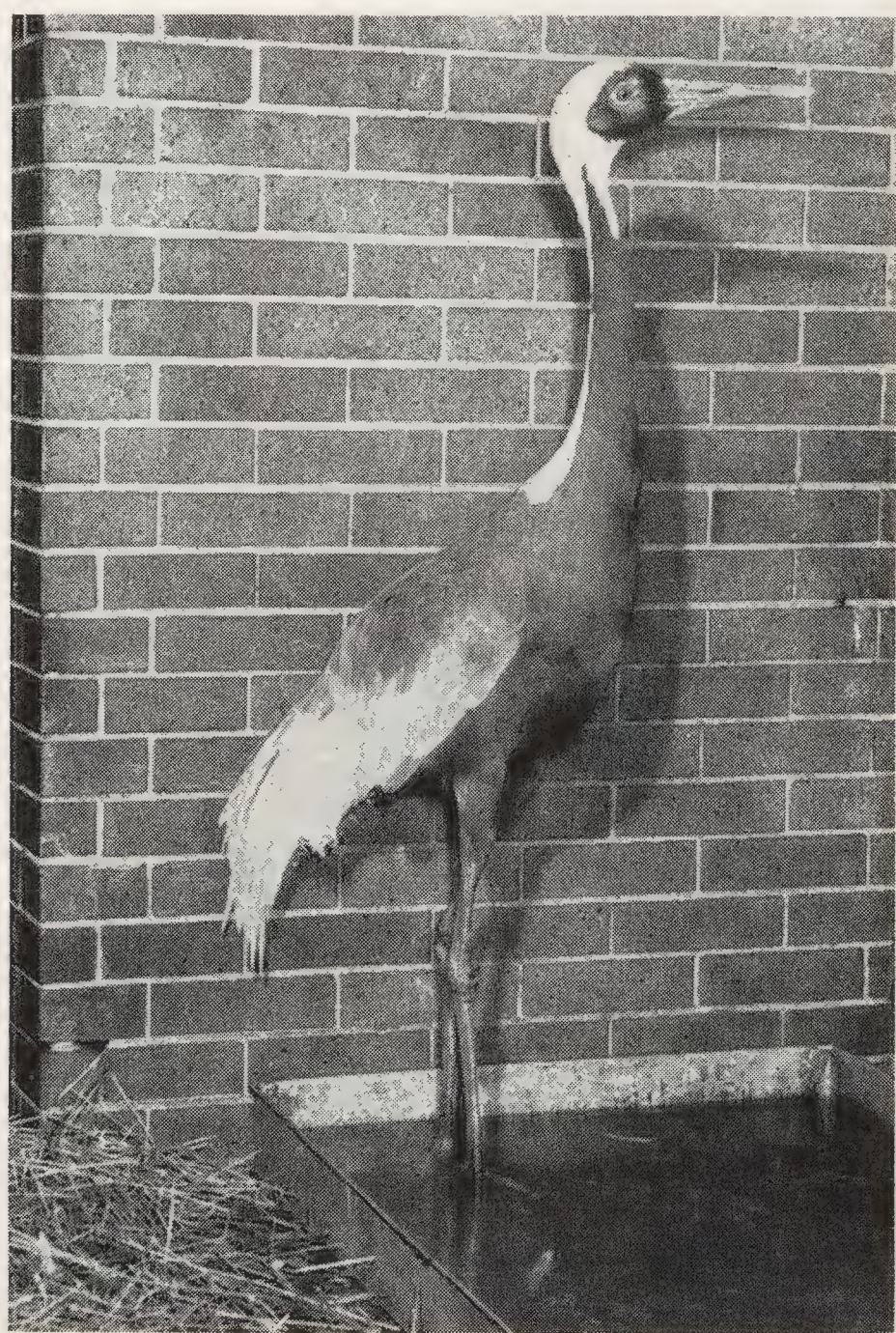
MY ZOO FAMILY. By Helen Martini. 295 pp., 32 pp. of photographs. Harper & Brothers, New York, 1955. \$3.95.

Mrs. Martini must need little introduction to most of our Members. The Animal Nursery in the Zoological Park has been in her charge ever since we established it some ten years ago, and its inmates and their foster mother have been a never-failing source of charming illustrations for our magazine and lively scenes for our motion pictures. Television and radio shows, many of them on a national scale, have on innumerable occasions testified to the public's fascination by a job that involves the rearing of exotic wild animals. "My Zoo Family" is Mrs. Martini's own account of the tribulations and triumphs, hard work and fun, that have filled her days and many an anxious night since the morning, a dozen years ago, when her keeper-husband brought home a new-born Lion whose mother refused to care for it.

Subsequently in the Martini home and in the Nursery in the Zoological Park there has been a succession of babies — tigers, leopards, gorillas, orang-utans, fawns, monkeys and marmosets and even such rarities as Tarsiers and a Yapock — and on all of them Mrs. Martini has lavished the affection and understanding and tireless care that are the secrets of her very real success with animals. In "My Zoo Family" she tells in considerable detail of her daily life in the Animal Nursery and in the two other animal buildings where, as supplementary jobs, she performed the duties of a regular keeper. The book is illustrated by fifty of the most striking and appealing of the hundreds of photographs made in the



A crude sling held it up.



And now it walks again.

Nursery, the Martini home and in the Zoo, by Staff Photographer Dunton and by news photographers of the various picture services. — W.B.R.

THE TIGERS OF TRENGGANU. By Lt. Col. A. Locke. Thirty-eight illustrations, two maps. Charles Scribner's Sons, New York, 1954. \$3.50.

Colonel Locke's book is not merely a series of hunting stories but essentially an account of the habits and natural history of the strongly marked but somewhat diminutive tigers of a specific area of Malaya. Trengganu is a State lying perhaps half way up the eastern side of the great peninsula that lies to the north of

Singapore. Its inhabitants are mostly Malays, with a scattering of Chinese who, through the centuries, have made but little impression upon the almost impenetrable forests and swamps. Here the tiger is completely at home, hampered but little by the occasional forays of villagers in defense of their livestock and occasionally their lives.

Colonel Locke writes with modesty and restraint but the story of the Jerangau Man-eater closely rivals the spine-chillers of Jim Corbett's "Man-eaters of Kumaon." A chapter on "Superstitions and Legends" and a detailed index round out this excellent volume. — L.S.C.

New Members of the New York Zoological Society

(Between November 1 and December 31, 1954)

Fellow

Dr. Aubrey Gorbman
Dr. Sophie Jakowska

Life

Ingram S. Carner
Wm. E. S. Griswold, Sr.
Bayard W. Read

Contributing

Archibald G. Alexander
Richard Allega
Mrs. Charles Allen, Sr.
Charles Betts
Miss Audrey Bruce
Mrs. Randolph P. Compton
Mrs. G. G. Dominick
Russel E. Duvernoy
Paul A. Draper
Bob Dvorin
Harry Eldridge
Mrs. Alice R. Evans
William K. Frank
John Harper
R. D. Holbrook
Jack Isreeli
Edward James
Miss Margaret I. Jensen
Louis Kenedy
William Kim
Dr. George H. H. Knight
Mrs. James F. Lawrence
Edward S. Litchfield
Mrs. John Adams Mayer
Jonathan W. McCann
John L. McCormick
Edward C. Meagher
F. Hamilton Merrill, Jr.
E. Moucha
Mrs. William S. Paley
Henry L. Pierson
John Pierrepont
Mrs. Malcolm Pitt
Mrs. David R. Raynolds
Alfred L. Rose
Winthrop H. Smith, Jr.
Roger W. Straus, Jr.

John T. Terry
Mrs. James L. Thatcher
Ethelbert Warfield
Mrs. Arnold Whitridge
Harry Zelenko
Dr. Clarence P. Zepp, Jr.

Annual

Stephen J. Albert
Ward Ames
A. B. Alexander
Charles J. Ayer
Mrs. Harold d'o. Baker
Walter Bareiss
Miss Ada M. Bartoli
E. Farrar Bateson, Jr.
Philip Bergh
Mrs. Robert Boggs
Victor Braunstein
Lester Bringsjord
Jackson R. Bryer
Gregory N. Camp
Mrs. Joseph M. Cannon
Stuart Caplin
John P. Carey
Charles Chiusano
Mrs. Francis T. Clark
Mrs. John K. Colgate
Lee Congdon
Brig. Gen. Jerome B. Crowley
Mrs. Albert Richard Diebold, Jr.
Randall M. Dubois
Mrs. Paul I. Fagan
Miss Susan Faragoh
Dr. Charles E. Farr
Master Jed Feuer
Paul Fitzpatrick
Miss Ann A. Fowler
Douglas Joel Futuyma
Wm. T. Genth
Mrs. Fitch Gilbert
Edward Graeffe
Hon. Ralph W. Gwinn
Miss Adele Hall
Mrs. Arthur J. Halleran
Harold M. Iseman

Mrs. Carle Jackson
Mrs. Thea Katzenstein
Miss Neissa Kubel
Dr. A. R. Lamb, Jr.
Dr. Andras E. Laszlo
Robert W. Lewine
Mrs. William A. Lincoln
Budd Lytton
Mrs. Paul Mazur
Dr. J. William Maller
Mrs. Ruth McGinty
Henry Meltzer
Miss Caroline Minetto
Miss Antonia Munroe
Mrs. Andre Newburg
Marshall O'Connell
Mrs. Arthur Oesterheld
James S. Ottenberg
Mrs. Paul G. Pennoyer
Master Kenneth E. Phillips
Richard Prince
Miss Lucinda H. Rand
Robert J. Reichert
Dr. Conrad M. Riley
Mrs. Salvador Ros
Dr. William L. Rumsey
Mrs. John Barry Ryan
Mrs. Peter Schoenburg
Mrs. Edward R. Schwartz
Morris Shelby
Donald N. Smith
Miss Barbara Sally Smyth
Peter V. Snyder, Jr.
Mrs. Harold Speert
John Philip Stern
Saul Sulkow
George Van Gorder
Harry Viosca
Hunt T. Wagstaff
Lawrence Waring
Robert S. Warriner
Charles Wissel
John P. West, Jr.
David Ogden Woolsey
George W. Young

Seen any good animals lately?

A GOOD MANY YEARS ago a couple of the Bronx Zoo's Curators wrote a book in which one chapter was entitled "Animals in Carpet Slippers." It was about the fun of visiting the Zoo in wintertime when a lot of the animals are indoors in the warm, the crowds are smaller and the general atmosphere is completely relaxed.

That's something to think about, if you as a Member haven't visited the Bronx Zoo for quite a while. In a number of ways, winter is the *best* time to see the Zoo — really to see the animals.

You'll have to walk — the Tractor Trains can't run in winter — but buildings are close together and they're warm. The Cafeteria is a bright, delightful place to have lunch and watch the wild ducks.

Phone our new telephone number, WEllington 3-1500, ask for the Publications Office, and we'll send you the little folder called "About the Bronx Zoo" that tells all the details — how to get to the Zoo, the hours, facilities, and so on.

SO YOU'RE GOING TO THE ZOO! HERE'S HOW TO GET THERE —

AUTOMOBILE. *From east New York City and Long Island:* East River Drive N. across Triboro Bridge; Northeast on Bruckner Blvd. to Bronx River Parkway; North to Exit 5 for Bronxdale Parking Field of Zoo, or Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field.

From Long Island: Across Bronx-Whitestone Bridge, continue on Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), thence W. to Zoo.

From west New York City and New Jersey via tunnels: Henry Hudson Pkwy. N. to Dyckman St. and Broadway; N. on B'way to 207th St.; turn E. on 207th St., Fordham Rd. and Pelham Pkwy. to Zoo.

From New Jersey via George Washington Bridge: Through tunnel at east end of bridge, up ramp marked "Bronx-Bronx

Whitestone Bridge," E. to University Ave., N. on University to Fordham Rd., E. on Fordham to Zoo.

From Westchester and Connecticut: Merritt Pkwy. S. to Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), OR Bronx River Pkwy. S. to Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field, or Exit 5 for Bronxdale Parking Field.

From western Westchester and upstate: Sawmill River Pkwy. S. to Mosholu Pkwy., skirt Botanical Garden southward to Pelham Pkwy., turn left to Pelham Pkwy. gate and Fountain Circle Parking Field.

SUBWAY. *West Side (IRT):* Northbound East 180th St. Express to 177th St. Walk N. to Zoo.

East Side (IRT): Northbound 241st St.-White Plains Rd. Express OR East 180th St. Express to 177th St. Walk N. to Zoo.



ANIMAL KINGDOM



NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT Fairfield Osborn	VICE-PRESIDENTS Alfred Ely Laurance S. Rockefeller Donald T. Carlisle	SECRETARY Harold J. O'Connell	TREASURER David H. McAlpin
		ASSISTANT TREASURER Percy Chubb, 2nd	

EXECUTIVE COMMITTEE

Laurance S. Rockefeller <i>Chairman</i>	<i>Class of 1955</i> George F. Baker, Jr. F. Trubee Davison John Elliott Robert I. Gannon Peter Grimm Fairfield Osborn Eben Pyne Laurance S. Rockefeller Archibald Roosevelt John M. Schiff Edwin S. Webster
John Elliott Alfred Ely Robert G. Goelet De Forest Grant Warren Kinney David H. McAlpin Robert Moses Harold J. O'Connell Fairfield Osborn	

BOARD OF TRUSTEES

<i>Class of 1956</i> Archibald S. Alexander Harry Payne Bingham A. Raymond Dochez Robert G. Goelet De Forest Grant Eugene Holman Warren Kinney William De Forest Manice Harold J. O'Connell Landon K. Thorne J. Watson Webb	<i>Class of 1957</i> Robert E. Blum Percy Chubb, 2nd C. Suydam Cutting Alfred Ely Marshall Field Childs Frick Henry Clay Frick Archer M. Huntington David H. McAlpin John H. Phipps
--	---

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Grace Davall . . *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandal *Assistant Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch . . *Assistant Curator, Education*
Quentin Melling Schubert *Superintendent,*
Construction and Maintenance
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. . *Research Associate in Ichthyology*
Harry A. Charipper . *Research Associate in Histology*
Homer W. Smith . . *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges . . . *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory
John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez
Alfred E. Emerson
W. A. Hagan
Caryl P. Haskins
K. S. Lashley
John S. Nicholas

AFFILIATES

C. R. Carpenter, *Co-ordinator*
Animal Behavior Research Programs
L. Floyd Clarke, *Curator*
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen
George E. Brewer, Jr.
Donald T. Carlisle
John C. Gibbs
Samuel H. Ordway, Jr.
Hugh J. Ross
Robert G. Snider
Peter M. Stern

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

- The Frilled Lizard** *Cover*
The Bower-birds
 A. J. Marshall 34
Big Bluff from Australia
 James A. Oliver 44
Spring Comes Along
 Donald T. Carlisle 47
Zoo News in Pictures
 Sam Dunton 48
**Those Puzzling "Little
Toms"** *Myron Gordon* 50
**Creatures of Sea Ice and
Tundra Barrens**
 *Katharine Scherman
 & Richard S. Miller* 56
**News from the Conservation
Foundation** 61
Behind the Scenes 62

Vol. LVIII **APRIL** **No. 2**
 1 9 5 5

Trustees for Animals

IN THE GENERAL RUN of human affairs optimism "pays off" far better than pessimism. This page, however, is not intended to comment about people but about animals — although it will do no harm if we people occasionally recall that we, too, are of the *animal kingdom*.

Animals have their own special problems but the hardest one most of them face is what to do about human beings. This is a grim question for animals and they have been forced to recognize that they are at our mercy. Except within the tender religions of the people in the Far East man's mercy towards other living things has for long been practiced so little that wild animals, the earth over, have come to hold man in uncontrollable fear.

The impression seems justified that, as a general rule, people of the Western World have had less compassion for animals than some of the peoples in the Far East, whose very religion has inculcated the conception of the inviolability of all living things. Nevertheless, now we have growing reason for optimism for within recent times a new conception has arisen that is growing ever stronger throughout the Western World. This conception finds expression in many ways including the steadily increasing recognition that man has become a trustee for wild living things. We are discovering that the quality of mercy "is twice blest . . . it blesseth him that gives and him that takes."

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.



Weeks of patient waiting went into the making of this photograph of a Yellow-breasted Bower-bird posing in its decorated bower.

Photograph by E. Thomas Gilliard

MILES FROM THE HOMESTEAD of an inland Australian sheep station (ranch), a man returned to his automobile and found its ignition key missing. It seemed that he was stranded. He knew that there could be no practical joker in the neighborhood. So, familiar with the habits of the Spotted Bower-bird (*Chlamydera maculata*), he walked half a mile to a bower whose location he knew. The shiny key and ring were there on the display ground.¹

Another bushman used to leave his glass eye

We Are Beginning to Understand THE BOWER-BIRDS

By A. J. MARSHALL

*Department of Zoology and Comparative Anatomy,
St. Bartholomew's Medical College, University of London*

in a cup of water by his bedside every night. In camp he awoke one morning to find the cup upset and the eye gone. The bushman was very attached to this particular eye and took a low view of its disappearance. The camp dog was suspected and had a poor time of it for the next few days. An autopsy was projected, but fortunately postponed. A fortnight passed. Then one of the bushmen, short of lead with which to make bullets to shoot a troublesome brumby stallion (wild horse) went to a nearby bower-bird's bower hoping to find some. He found not only the desired lead, but, in addition, his mate's glass eye. It stared vacantly up from among the bleached bones, shells and odd pieces of shining metal and glass that the birds had accumulated for use in their display.²

In the Ord River country of West Australia a gentleman named Edward Delaney lost his spectacles. They were found at the bower of a Great Gray Bower-bird (*Chlamydera nuchalis*).³ The collector S. W. Jackson had to retrieve stolen table silver and his entomological forceps from a bower. He reported also that "anything bright"

in his camps had to be kept shut up in a box.⁴ Precious opal has been found on display ground in opal-bearing country as well as small glistening nuggets of gold embedded in pieces of quartz.⁵ Bower-birds have been known to steal jewelry from dressing tables near open windows. After country race meetings Australian aborigines sometimes make a tour of nearby bowers to collect odd silver coins found and taken there by the scavenging birds.

Another writer reported that quantities of metal staples were stolen from along a line of newly sunken post holes. Nuts, bolts, thimbles, screws, penknives, wire, broken glass (especially) have been found at bowers. In the old days, when unpainted metal buttons were worn, bower-birds sometimes hopped close to bushmen in order to inspect them.

These stories, of course, seem wildly improbable — but they are, in fact, true. They all relate to the Spotted and Great Gray Bower-birds. These species inhabit the dry inland, and lightly forested northern areas of Australia. They habitually accumulate at their bowers great collections of bleached and reflecting articles.

Most people believe that bower-birds simply accumulate indiscriminately a heap of varied, colorful rubbish. In actual fact, the different species select their bower decorations with a remarkable discrimination. The Satin Bower-bird (*Ptilonorhynchus violaceus*) of the eastern Australian rain forests and their fringes collects only objects colored blue, greenish-yellow, gray and brown. At one country hotel I know, Satin-birds regularly invade the laundry and purloin washing bluebags. A display ground nearby was always smothered with bluebags, together with the usual array of freshly picked bluebells, greenish-yellow *Billardiera* blossoms, pieces of gray sloughed snakeskin, brown snail-shells and other objects. Flower growers in districts where Satin-birds live usually have to shoot them if they are determined to keep them out of their gardens. The birds become so bold that they will wrestle with “spikes” of delphinium blossoms larger than themselves within a few yards of the aggrieved gardeners. They like also petunias, cinerarias, cornflowers, irises and hyacinths. These are quickly wrenched off and carried to bowers in the rain forest to join the odd blue and greenish-

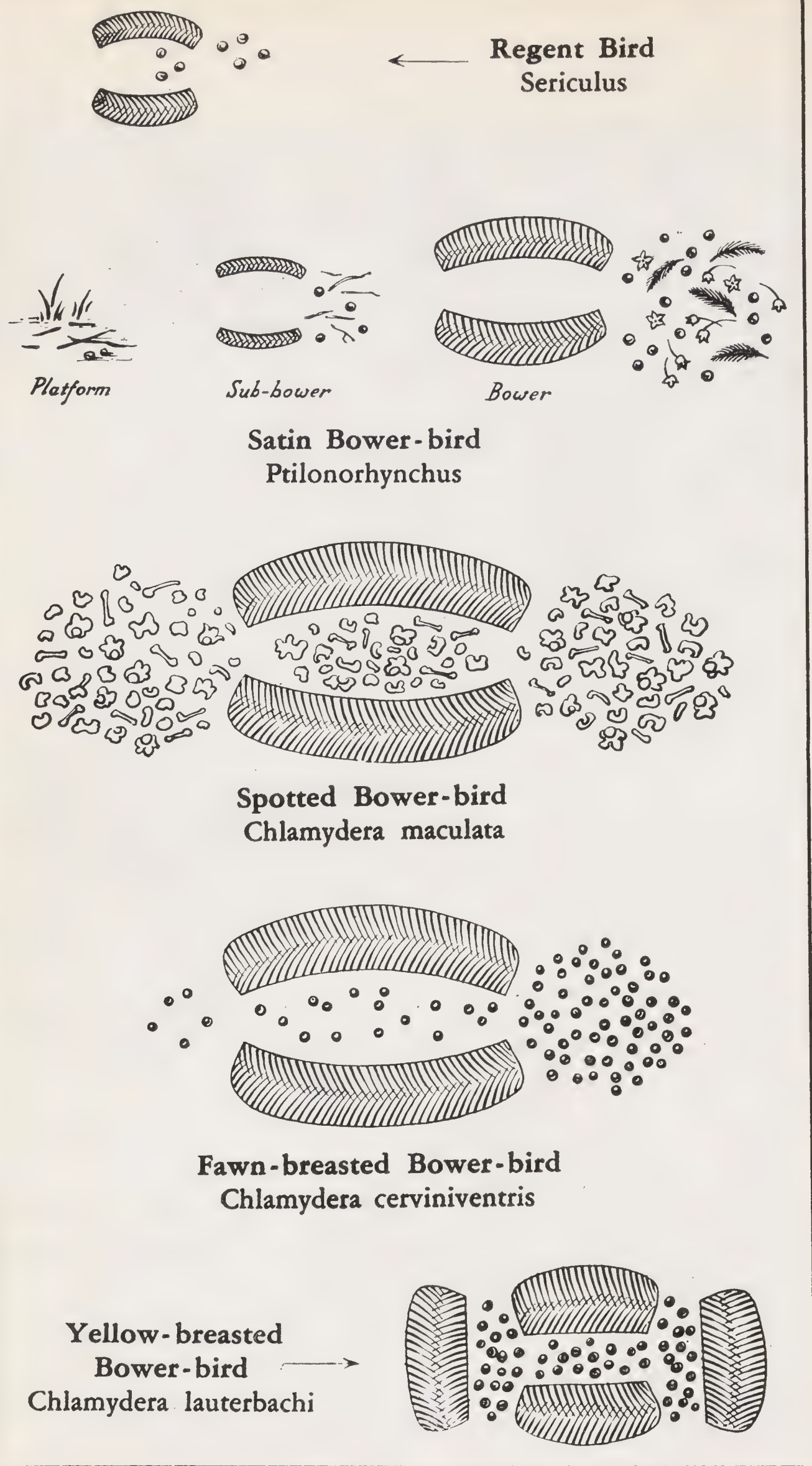


Here is the bower of the Yellow-breasted Bower-bird in broader view, showing the assortment of round red, blue and green seeds and blue clay or pebbles used by this bird.

Photograph by E. Thomas Gilliard

yellow bush flowers and the motley accumulation of blue parrots' feathers, bus tickets, glass, fragments of blue-bordered china, discarded hair ribbons and other *miscellanea* there. An aviculturist who unwisely tried to keep blue finches in the same aviary as a male Satin-bird found that the finches were killed one by one and taken as decorations to the display ground. Finches of other colors were not molested.⁶

Bower-birds (*Ptilonorhynchidae*) are passerine (perching) birds not unrelated to the birds of



BOWERS OF AVENUE-BUILDERS

Eight species of bower-birds widely distributed through Australia and New Guinea are builders of the avenue type of bower. Essential features are a basal platform of twigs on which is set a double wall of twigs to make a central avenue. Colored objects are placed on the display grounds at one or both ends.

Drawings on Pages 36 & 37 from the Author

paradise. They exist only in Australia and New Guinea. The males are often very beautiful. Their bowers are built of twigs, always on the ground, and have no direct connection with the nests. These are placed in trees, often some hundreds of yards away. Early Australian explorers who first observed bower-birds' display grounds

thought that they were a kind of toy built by native mothers for the amusement of their children. Very soon, however, it became known that birds, not aborigines, made them. The first bowers found were of the *avenue* type — a pair of symmetrical walls of twigs with just enough room in between for a single bird about as big as a small pigeon to pass through. At one, or sometimes both, ends of the central avenue is always arrayed the pile of distinctive display things. Some species scatter their decorations through the avenue as well. One avenue-builder, the Yellow-breasted Bower-bird (*Chlamydera lauterbachii*) of New Guinea, has extended the simple double-wall plan by adding two more walls at right angles and so constructs three avenues. In all of these passages it strews blue, green and red berries, pieces of blue clay and slate-colored pebbles.

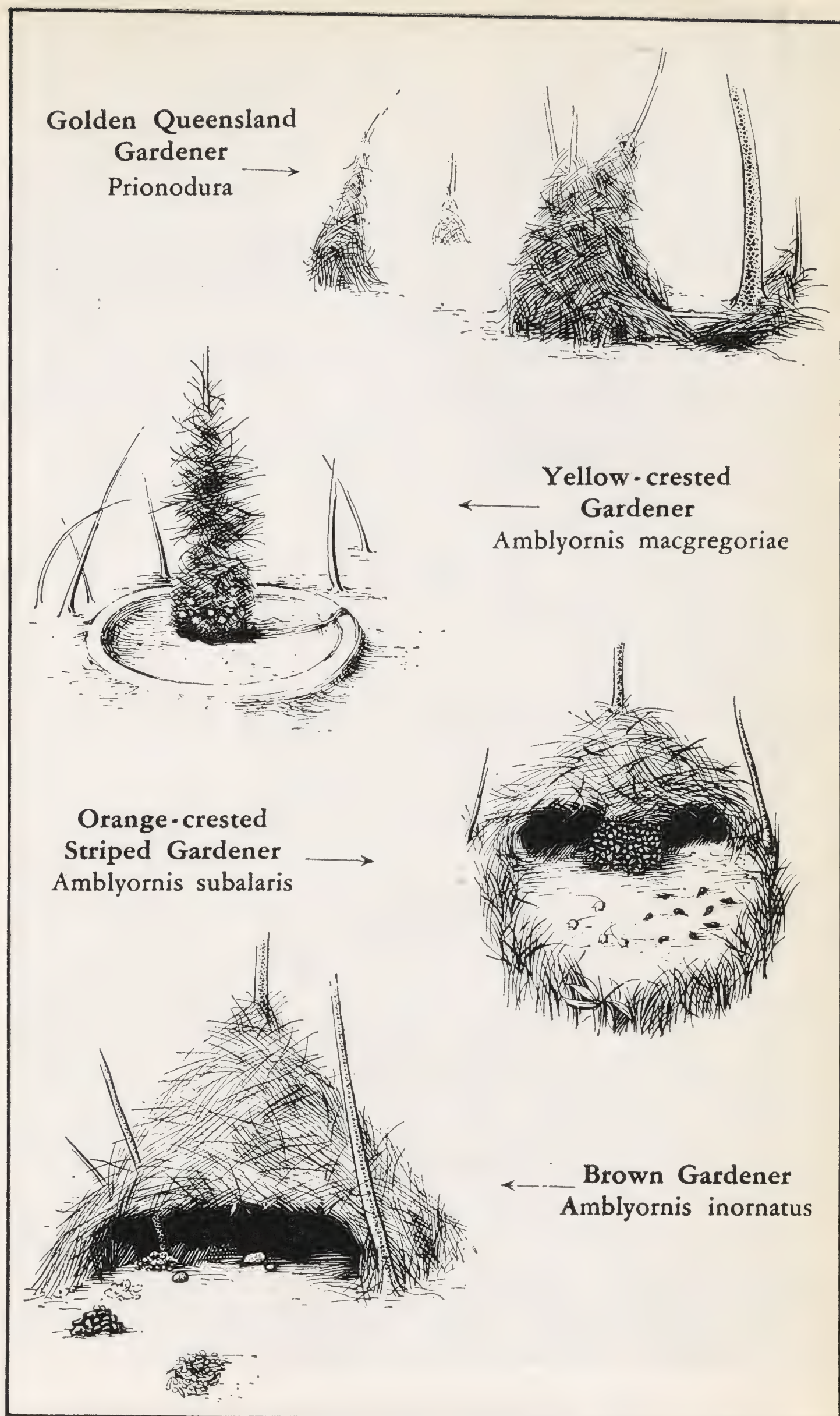
Apart from the avenue-builders there exists a group that I have called the *maypole*-builders, about which very little is known.⁷ With one exception all are confined to the dense rain forests of tropical New Guinea. In each case the fundamental features of the bower are a rigid supporting central tower (a thin sapling growing in the forest) and a cone of fabric that is packed about its base. The tower sometimes supports a spherical (as built by *Amblyornis inoratus*), or a hemispherical (*A. subalaris*) waterproof hut or a secondary tower of fabric (*A. macgregorii*). These maypole bowers are sometimes fronted with a living lawn of transplanted moss and this display ground may be decorated with fresh flowers, fruit, fungi, colored beetles' wingcases or snail-shells. Thus the maypole-builders have come to be known as the Gardener Bower-birds. The Golden Queensland Gardener (*Prionodura newtoniana*) decorates the spacious fabric of its double-towered maypole bower with living orchid plants. These continue to grow and flower on the new site. Very little is known about the maypole-builders because all inhabit tropical jungles remote from heavy European settlement.

Yet a third type of bower is built by the Gold-crested Black Bower-bird (*Archboldia papuensis*) of New Guinea. This beautiful bird was discovered by the American Museum of Natural History-Archbold Expedition as recently as 1938⁸ and the first good description of its bower was

not published until last year.⁹ The Black Bowerbird builds neither an avenue nor a maypole bower. It simply clears a patch of jungle floor and strews the space with dry fern fronds, grass and twigs. To this primitive circus arena it brings a small collection of snailshells, black beetles' wings and blue berries. Very few people have seen the Black Bowerbird, but enough display grounds have been found to make it clear that it never actually *erects* a bower-like structure on its elementary arena.

In addition to the above three stems of bowerbird evolution, the family Ptilonorhynchidae, as at present constituted, also includes the distinctive Catbirds. These, of course, are of no relation to the North American bird of that name. They are exclusively jungle dwellers which, although they do not build bowers, are obviously derived from the same ancestral stock. Of the Catbirds, two (*Ailurædus*) are greenish in coloration and rarely leave the heavy concealing foliage. The third, the famous Stagemaker, or Tooth-billed Catbird (*Scenopæetes dentirostris*), has taken partly to the forest floor, developed a harmonizing brownish plumage and a special "toothed" bill. With this remarkable beak it laboriously saws through the petioles of leaves. When these are severed, it carries them to a cleared space on the jungle floor and arranges them with paler under-surface uppermost, in conspicuous display. One Catbird, the White-throated species (*A. buccoides*), is confined to New Guinea. The second, the Green Catbird (*A. crassirostris*), is widespread right through from western New Guinea to southeastern Australia. The leaf-sawing Stagemaker is restricted to a relatively tiny "island" of jungle in wet, mountainous, tropical northeastern Australia.¹⁰

In all true bower-birds so far studied, the brilliant male displays to a female which sits impassively behind or within the bower. She takes no part in the performance. The sun flashes on his body plumage, or upon his erectile head or neck plumes as he gyrates energetically, often violently, in display to the accompaniment of a remarkable vocalization. He savagely drives all intruder males away from his display ground, the focal point of his sexual territory. When the Satin-bird, for example, leaves his bower to feed or bathe, a rival will quickly skulk in through



BOWERS OF MAYPOLE-BUILDERS

Except for the Golden Queensland Gardener, the maypole-builders are confined to the largely unknown tropical rain forests of New Guinea. A slim sapling, at the base of which is packed a cone of fabric, is an essential feature of the maypole bower and around it each species builds its own kind of structure.

the undergrowth and begin to wreck his bower. When the owner sees what is going on he returns with a swift rush of wings. The intruder always flees. He often snatches up a beakful of blue parrot's feathers or flowers as he retreats.

Some avenue-building bower-birds — the Satin, Spotted, Great Gray and possibly the Regent-



The Fawn-breasted Bower-bird builds an avenue and decorates its display ground principally with green berries of various kinds. It sometimes employs bleached objects also.

Photograph by Lee S. Crandall

bird (*Sericulus chrysocephalus*) choose their decorations specifically to match the most striking plumage and other physical features of their own species. It was formerly thought that the choice of ornaments was governed by the colors of the female^{11, 12}, but I have recently presented experimental evidence that the male Satin-bird at least chooses his display things to match the colors of rival *males*.⁶ The females and young males of the Satin-bird are greenish in coloration, with brilliant blue eyes and yellow underwing coverts. The plumage has also various shades of brown

and gray. We have seen that the Satin-birds' display ground is always smothered with these colors even though, in the forest, the bird has an unlimited range of color choice. When three or four years old, the males change their color to a brilliant lustrous blue-black and at the same time the beak changes from a dull horn to bluish, edged with greenish-yellow. It was not until 1954 that it was discovered that the curious choice of flowers colored yellowish-green (a shade relatively rare in nature) is related to the small, though conspicuous, similarly colored area on the beak of the adult blue-black male. In experiments, adult males ignored the detached horn-colored beaks of dead females and young males, but avidly brought the greenish-yellow beaks of old males to the display ground. With these they displayed vigorously to their watching females.

The Spotted and Great Gray Bower-birds have pallid ventral areas and lilac crests that glint silver in the sunlight. The males of these species bring bleached and reflecting objects to their bowers. The male Regent Bower-bird is brownish in the young male, and brilliant gold and velvet black in the adult. The decorations chosen in the bush are predominantly brown, black and occasionally golden.

On the other hand, some avenue-builders do not seem to try to match the rival's plumage with their decorations. The Fawn-breasted Bower-bird (*Chlamydera cerviniventris*) of North Australia and New Guinea chooses principally green berries. The Yellow-breasted Bower-bird (*C. lauterbachii*) of New Guinea collects red berries, blue berries, blue clay and slate-colored stones. Among the maypole-builders, too, there seems to be no correlation between plumage color and the decorations that the males bring to their bowers.

At least two of the avenue-builders are known to orientate their bowers in a special way. Thus, both the Satin-bird and the Great Gray Bower-bird point the avenue along the path of the sun. Other avenue-builders (e.g. Spotted Bower-bird) site it in any direction. So faithful is the Satin-bird to the north-south direction that when I experimentally altered the bearing of bowers the owner demolished one wall, altered the bearing of the other, and then built a new third wall from the twigs taken from the first. Soon it was pointing almost along the original line.⁶

All three avenue-builders that are at all well known have been found to paint the inner walls of their bowers. One of the first two recorded observations of this habit was made in the New York Zoological Park. In 1922 Lee S. Crandall was told of a blue male Satin-bird that nibbled particles of soft wood from a sieve carried by a keeper. It mixed the wood fragments with saliva and coated the inside walls of its bower with the resultant paste. Mr. Crandall placed a piece of dry rotten wood in the cage. The paint was now on the house, so to speak, and "an orgy of plaster-

A new bower and freshly collected bleached shells of the Great Gray Bower-bird of tropical North Australia. This species orients its bower north-to-south.

Both photographs by the Author

An intruder male Satin Bowerbird in the act of wrecking the bower of a rival. The display ground is in front and is strewn with blue parrot's feathers, yellow straw and snail-shells.



ing followed."¹³ A year or two before this, Nubling^{12, 14} had seen bush birds use what was probably fruit pulp and several years later Gannon and several other Sydney naturalists saw birds crush in their beaks charcoal (from logs charred by bush fires) and then wipe a sticky black mixture on the bowers.¹⁵ In the bush the Satin-bird often shapes with its beak a flat pellet of bark. This it holds towards the end of its bill while applying the paint. The manufactured tool acts as a combination sponge and stopper. As the bird wipes each twig the black suspension adheres and results in an embellishing black band on each side of the avenue.

The Spotted Bower-bird chews up dry grass with saliva and plasters twin reddish-brown bands of material on its bower walls.¹⁶ The rarer Regent Bower-bird plasters its bower with fruit pulp.¹⁷ It is not yet known if the habit is practiced by other species of avenue-builders. Relatively few of their bowers have been carefully examined.



The hut-like bower of the Brown Gardener Bower-bird of New Guinea. The central "maypole" sapling and the basal cone are not shown. Decorations are fruit and flowers.

Photograph by S. Dillon Ripley

WHAT ARE THE ORIGINS and functions of these elaborate behavior patterns? Bizarre as they are, I believe that bower building, color selection, painting and so on are merely remarkable extensions of phenomena that hardly excite comment in more commonplace birds. Certainly I do not think that we need to postulate, as many have done, any special intelligence in bower-birds. The Satin-bird, which has achieved perhaps the most elaborate degree of ritualization of any known bird, is not sufficiently *intelligent* to scratch aside leaves under which favorite insect food has taken refuge in the aviary. It eats fruit and flying insects. It snaps up anything that moves, but lacks the elementary reasoning power to scratch aside concealing debris. The Stagemaker has not learned that a single simple downward jerk of the neck will almost certainly detach at least some of the leaves that it laboriously severs each morning to decorate its jungle

arena. It has the nervous and muscular equipment to do the job more quickly (with at least some easily detached leaves), yet it has never discovered the simple short cut.⁶

Bower building, color selection, painting and so on seem to be governed by innate, unconditional reflexes. They are probably merely curious "larger-than-life" bower-bird extensions of quite well known avian activities. Take bower building and display, for example. Most, if not all, birds have some form of sexual display and many, as widely unrelated as pheasants, waders and birds of paradise, clear an arena on the forest floor. Again, many kinds of birds — e.g. doves, cormorants and cuckoos — will snatch up odd objects, twigs, flower petals and especially nest material, and use them momentarily in their everyday display. This kind of display, involving the use of nest material or some other handy substitute in an apparently inappropriate situation, is probably a form of *displacement activity* in the terminology of modern ethologists. Something akin to this can be seen in the nervous needless fumbling of the tie by a man waiting, for example, to make an important address. Such ac-

tivities have become ritualized, habitual and valuable in many animals, including especially bower-birds. I see bower building, for example, as a displaced nest building drive. Nest building in most species is of a bisexual nature. Only female bower-birds build nests; the males stay aloof from domestic duties and remain preoccupied with their beloved display grounds when the females go away to lay and incubate. Nest building (with twigs in the case of bower-birds) is under the influence of sex hormones. The same is true of bower building in the males. During the sexual season they have taken to arranging twigs in various ways in their display grounds, the focal point of their interest.

When I castrated male bower-birds they stopped building bowers and ceased to display. When I injected the castrates with male sex hormone the typical male display behavior was re-established.¹⁸ The enchantment of the bower and the display with colored and other distinctive articles is probably simply a grotesque extension of the displacement activity that involves, in less

“complicated” birds, the occasional seizing of a twig or a flower petal and its use in moments of sexual excitement.

Some bower-birds have gone further still and have come to select colors which harmonize with prominent physical features of rival males. We saw above how savagely the male Satin-bird defends his bower territory and how violently he (and males of other species, too) displays with the decorations he brings to the bower. In several (but not all) bower-birds, the displaying male seizes, and displays noisily and violently with, objects colored in the rival’s image, so to speak. The male makes continuous threat gestures in display, but the threat is directed at the colored ornament, and not at the watching female. She stands impassively within or behind the bower with all the appearance of unconcern

The Golden Queensland Gardener built this and decorated it with living orchids. The “display stick” is just above the hat. Here the male probably displays his plumage.

Photograph by the Author



or, if we may use an expression that smacks of anthropomorphism, even boredom. The excitable display of the male, however, holds her interest. Its violence keeps rivals away. And so, if the male is sufficiently attractive and aggressive, the female will still be at the bower when the mating season arrives.

Likewise, bower painting is almost certainly displaced courtship feeding. Courtship feeding, practiced by innumerable species, is in itself a displacement reaction. The male bower-bird, kept for weeks to his display by the aloofness of the watching female, projects his innate tendency towards courtship feeding on to his bower. Some bower-birds rub fruit — a favorite food — on the bower. Some, as we have seen, have evolved a more elaborate mechanism involving chewed-up grass or ground charcoal. The resultant embellishing twin bands of black or brown pigment on the inside walls probably makes the bower

more attractive to its owner and perhaps to the female as well.

The display continues for weeks or even months until (in some bower-birds at least) the forest becomes seasonally full of special insects on which the young will be fed. Bower-birds eat mostly fruit but, like most other birds, they change to an essentially protein diet in the breeding season. If, in captivity, the parents are deprived of protein food, the young die of malnutrition in the first ten days of life. When the seasonal harvest of cicadas, Christmas beetles and flying termites appears, the male transfers his physical attention from the display objects to the female which has waited so long beside the bower; she then goes off and begins to build her nest. After further delay she lays her eggs. She rears the young entirely without male assistance.

The male's display served to attract her to his territory months before. It then helped synchronize their respective internal reproductive apparatus and kept the pair together until the environment reached a condition appropriate for reproduction and the successful rearing of the young. I believe that it is the long period of sex hormone liberation, without physical contact, that has enabled the development of the extraordinary display activities described above. The male energies have flowed into a vacuum, so to speak, created by the female's unwillingness to mate until the environment became suitable for successful reproduction.

In advancing a hypothesis which seeks to explain the complex bower-building allied phenomena on essentially utilitarian grounds, I do not suggest that the birds fail to enjoy the bizarre and perhaps aesthetic activities that they perform. But whether this enjoyment has much in common with that of man engaged in comparable pursuits has yet to be proved. For example, although many bower-birds collect objects that appear beautiful to us, we have no proof that they are "beautiful" (in our sense of the word) to the bird. If all bower-birds made collections of bleached bones, less would be written about

In the luxuriant tropical rain forest of north-eastern Queensland live the Golden Gardener, the Green Cat-bird and the Stagemaker.

Photograph from Queensland Government





Each morning the Stagemaker places fresh leaves upside down on its stage, and sometimes breaks snail-shells on an "anvil" beside the display ground. Shells at lower left.

Photograph by S. W. Jackson

beauty or aestheticism. Yet nobody would suggest that the pile of dead bones and snail-shells is any less "beautiful" to *Chlamydera nuchalis* than is the rather more agreeable (to us!) collection of blue and red berries to *C. lauterbachii*.

We know that the choice of decorations is mechanical and inherited. A species that collects principally deep blue and lemon yellow never varies its display to red and white (nor even to pale blue and gold) as would a woman arranging flowers. We are now trying to breed bower-birds in London. If we succeed we will separate the young from the adults at an early age and thus discover how much more of their display is innate and how much, if any, is learned from the male parent. The evidence so far suggests that although bower-birds improve their performance with age and experience, their display activities are governed entirely by innate behavior pat-

terns. These seem to be annually called into play when the seasonal flow of sex hormones stimulates special centers in the central nervous system.

REFERENCES

- ¹ Bailey, H. F. (1934) *Emu*, **33**, 186.
- ² Chisholm, A. H. (1929) *Birds and Green Places*. London.
- ³ Kilgour, J. F. (1904) *Emu*, **4**, 37.
- ⁴ Jackson, S. W. (1912) *Emu*, **12**, 65.
- ⁵ Day, W. S. (1904) Cited by North, A. J. *The Nests and Eggs of birds found breeding in Australia and Tasmania*. Sydney.
- ⁶ Marshall, A. J. (1954) *Bower-birds: Their displays and breeding cycles*. Oxford.
- ⁷ Marshall, A. J. (1954) *Bower-birds*. *Biol. Rev.*, **29**, 1.
- ⁸ Rand, A. L. (1940) *Amer. Mus. Nov.*, **1072**, 1.
- ⁹ Mayr, E. and Gilliard, E. T. (1954) *Birds of Central New Guinea*. *Bull. Amer. Nat. Hist.*, **103**, 315.
- ¹⁰ Marshall, A. J. (1951) *Proc. Zool. Soc. Lond.*, **120**, 149.
- ¹¹ Morrison-Scott, T. C. S. (1937) *Proc. Zool. Soc. Lond.*, **107**, 41.
- ¹² Nubling, E. (1941) *Austr. Zoologist*, **10**, 95.
- ¹³ Crandall, L. S. (1932) *Bull. N. Y. Zool. Soc.*, **35**, 65.
- ¹⁴ Nubling, E. (1921) *Emu*, **21**, 11.
- ¹⁵ Gannon, G. R. (1930) *Emu*, **30**, 39.
- ¹⁶ Chaffer, N. (1945) *Emu*, **44**, 161.
- ¹⁷ Goddard, M. T. (1947) *Emu*, **47**, 73.
- ¹⁸ Marshall, A. J. (1950) *Nature*, **165**, 388.



Big Bluff from Australia

By James A. Oliver

C*hlamydosaurus kingi* is the long and rather formidable scientific name of a rare, rather longish and sometimes formidable-looking lizard from northern Australia. The common name of Frilled Lizard is an easier one for most of us to use. Actually both names mean virtually the same thing since *Chlamydosaurus* is derived from two Greek words meaning mantled or cloaked lizard. The *kingi* is the scientific designation for the particular species and is based on the name of its discoverer, Captain King. On January 25 of this year the Frilled Lizard, *Chlamydosaurus kingi*, became a reality for us when two healthy specimens arrived safely to represent their species in our collections for the first time.

The Frilled Lizard is one of the most remarkable lizards in the world, primarily because of its unique frill or mantle but also because of its interesting habits. The frill is a large, umbrella-like structure surrounding the neck. When not in use it lies neatly folded alongside of the neck,

and from a distance the creature looks ordinary and unspectacular. But as soon as the frill rises, it becomes awesome, certainly looking considerably larger in size. Adult males attain a larger size than females, sometimes reaching a length of three feet, and in them the raised frill may be as great as nine inches in diameter. The accompanying excellent pictures by Staff Photographer Dunton show clearly how much the frill increases the apparent size of the lizard beyond the diameter of the head.

The supports for raising the frill are elongated processes of the hyoid bones of the throat. The basal bones of the series articulate with the lower jaw in such a way that the frill can be raised only when the mouth is opened, and it must be fully opened to raise the frill to full size. However, the mouth can be opened, as when eating, without the frill being raised.

This frill is a truly spectacular example of a threat or "scare" structure. It is raised in an instant and the resulting transformation in the

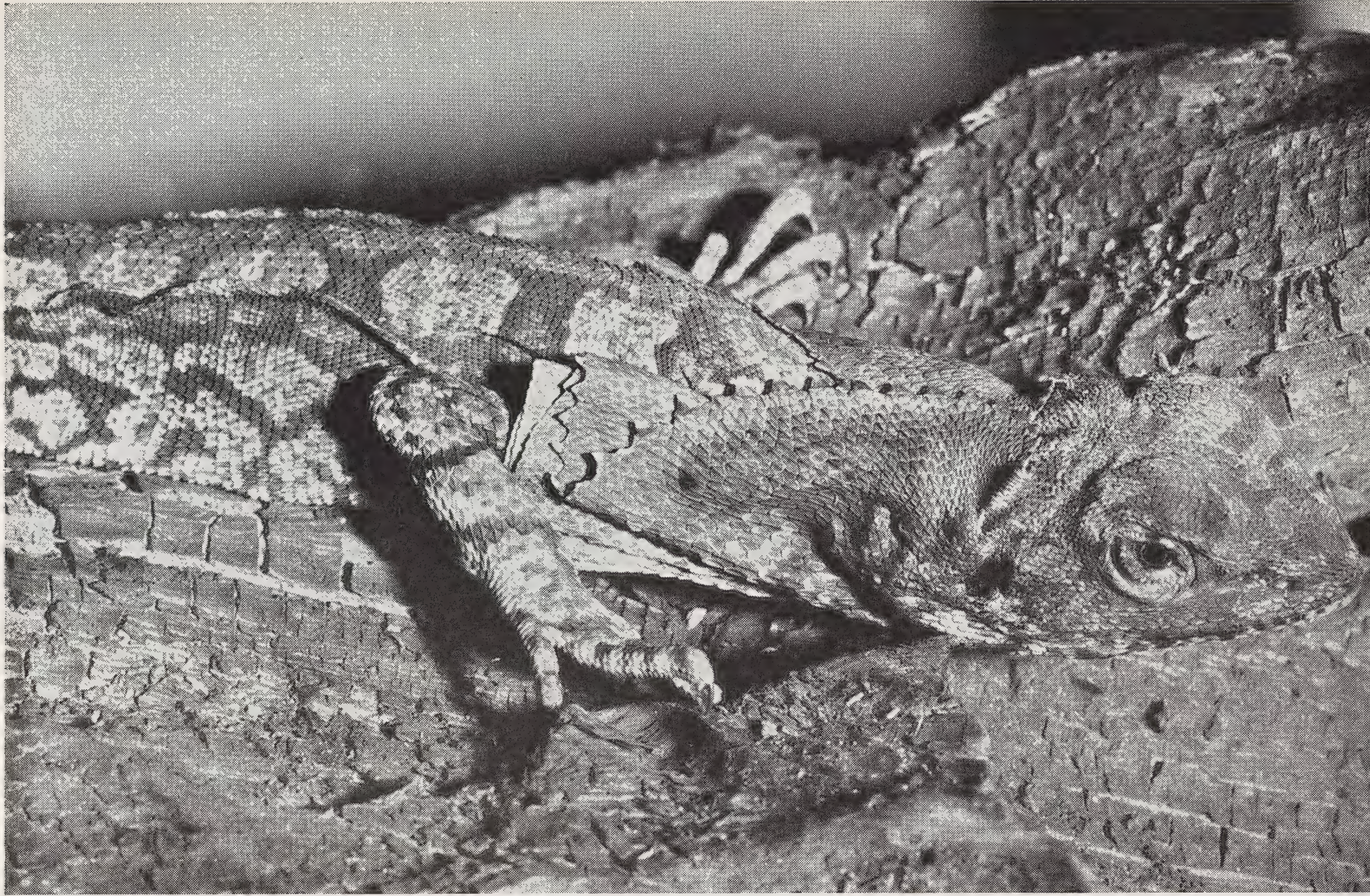
lizard is amazing. Much of our knowledge of the natural history of this interesting reptile was obtained in the late 19th Century by W. Saville Kent in northwestern Australia. He found considerable differences in temperament between individual lizards. Some could not be induced to raise the frill under any circumstances while others, usually large males, were easily excited to the point of putting on a complete display of their defensive behavior. He commented on "the general habit they manifested, if much excited, of standing at bay with open mouths and erected frills, uttering a hoarse, hissing noise, and lashing whip-wise at the intruder with their long, rough tails. The blows thus delivered were dealt with such vigor as to smartly sting the hand if exposed to the impact."

LEFT—The Frilled Lizard in unalarmed pose with frill folded back. BELOW—The frill is up and the mouth open when an enemy, in this instance an Australian snake, comes close.

Our two lizards are docile to the point of being phlegmatic. We tried to excite them with quick motions on our part, with a cat approaching in a threatening manner and with an Australian Sulphur-crested Cockatoo nodding quickly toward them, but all without success. Finally we took an Australian Tree Snake and allowed it to crawl toward the lizard. When the snake got within about a foot of the lizard's head the effect was startling, the lizard flashed its frill to full capacity and the snake departed in the opposite direction. This is the only way that we can induce either of our lizards to perform this feat for us — by letting a snake crawl toward it.

The effectiveness of the frill is enhanced by the fact that the brightest and lightest colors of this otherwise drably colored lizard are on the front of the frill. Males are more brightly colored than females. Kent says that the colors form a mosaic pattern of orange, vermillion, steel-blue and varying shades of brown. One of our specimens is a male and the other a female. The frill





The frill at rest behind the lizard's head is always folded in the same creases. Both males and females have frills, and the male's is the brighter of the two. This is the male lizard.

of our male is somewhat more colorful than that of the female, but the brightest color is a reddish-brown. The brighter pigments recorded by Kent may indicate considerable individual variation in this respect or may suggest a seasonal change. The Frilled Lizard is a member of the Family Agamidae, a group of lizards found only in the Old World. Males of several species in this family are noted for their marked change in color during the breeding season, when they become much brighter than females. Possibly a similar change takes place in the Frilled Lizard.

These lizards are partly arboreal and are found in the wooded scrub-lands, frequently on the trunks or lower limbs of large trees. The fingers and toes have long, sharp, recurved claws that enable the creatures to climb with agility. Frilled lizards are among a small number of species in both the Old and New World that can run on the hind legs alone. This unusual method of

locomotion is employed when great speed is needed. The Frilled Lizard, with its frill flapping loosely at the side of its neck, looks especially odd when proceeding in this manner. Kent says that it will run for 30 or 40 feet in this fashion, rest momentarily on all fours and then be off again. When he first reported his observations in 1895, no other lizards were known to have such an unusual type of locomotion. This amazing feat and the unique frill evoked a comparison of the lizard with mythical dragons and fossil dinosaurs. In fact, the name "Frilled Dragon" is sometimes used for it. Of course, it has no affinity with such imaginary animals as dragons and is no more closely related to the reptilian dinosaurs than other living lizards. Kent managed to bring one live specimen to London where it performed its bipedal locomotion before a group of eminent scientists. So strange were its ways that one zoologist followed it excitedly on hands and knees. While we have learned much about the ways of lizards in the intervening years, there is still a great deal to be learned and *Chlamydosaurus kingi* is still a species to evoke interest and enthusiastic study.

Spring Comes Along—Eventually

By DONALD T. CARLISLE

MANY of our members would like to know just when and where we greet spring at the Zoo. Why we keep the following information to ourselves year after year we frankly do not know, for it seems quite certain that many a member would have a fine day of it taking a small child to the Children's Zoo on opening day.

The folk who decide these matters have to say "1st good weather weekend" as they plan the spring openings of our Souvenir and Service Stands, and the outdoor refreshment opportunities at Lake Terrace. All sorts of quick bites at the latter but no hot coffee nor tobacco at the Service Stands. The Big Wheels assign definite dates for all the other openings.

Flamingo Terrace resumed operations for 1955 on March 19. That's the restaurant in Bird Valley between the Eagles and the Aquatic Bird House. Here you can get cafeteria service in hot meals. Candy, publications and camera films on sale too.

Boaters ahoy since March 26! You rent rowboats at the Boathouse east of the Boston Road Gate. The charge is 75¢ an hour, 15¢ extra for each fifteen minutes of overtime use, and \$1.25 deposit on the craft. No discount to professionals from the U.S.N. No rentals after 5:30 p.m. and a curfew at 7:00.

Young Mothers and others harrassed by the smaller small fry can rent *strollers* from April 2 through the season—at all gates except big bronze Rainey Gate. The charge is 60¢ for three hours' use (no rebate if you use it for only two) and 15¢ per hour for overtime. There's a \$3.00 deposit necessary—and this stroller service is one of our more humane gestures.

The same day, April 2, service will be resumed at *African Terrace* restaurant—down near the Boston Road Gate, across the way from the entrance to the African Plains. Sandwiches and

other light refreshments. Candy, films and publications too.

On April 9 the *Zoobar* opens—one of the most attractive outdoor luncheon spots on the Eastern Seaboard. Here you may sit under the plane trees, sip your beer, listen to music and watch the elephants play leap frog—all this at mild expense.

Right over the fence on April 9 the *Children's Zoo* will begin its 1955 season. This is something not to be missed—the little fellers mixing it with the critters for the first time this year. Admission for adults involves juvenile accompaniment: Big folks 16¢; little ones 21¢. The fun will start at 10:30 a.m. and the animals will all yell "Uncle" at 1½ hour before Zoo closing time.

On April 16 the *Farm-in-the-Zoo* will be opened again with horses, cattle, hogs, sheep, goats and all forms of domestic poultry except maybe guinea hens. But there will be baby chicks hatching sous cloches, and cows will be milked at intervals. A great place for youngsters to meet their more important animal friends. Everybody over 4-years old pays 16¢ to get in, except that school or other organized groups with leaders come in free. Hours: 10 a.m. to ½ hour before closing.

On April 16 the Farm Service Stand also opens with our regular line of service stand merchandise *except* that we add "rube" souvenirs and rural straw hats.

You must save your questions until April 24 when the *Question House* leads with its chin and dares any and all to come up with some stumpers. Besides *free* information about animals and where the subway is, we *sell* publications and film including motion picture film there.

Later on we will let you know about the Annual Garden Party for Members at the Zoo. But please don't wait 'til then. Come up for some of these other events. They're *all* fun.

ZOO NEWS

IN PICTURES • BY SAM DUNTON



◆ Sumatran gorilla, is now 10 years old and is the latest we





▲ A young Giant Otter from Brazil, the first in our collection. It is about 40 inches long, but old males may reach seven feet.

Mountain Go-
even years
readily. Her
60 pounds.

The larger of the two seals below is the Gray Seal, recently received. It shares a pool with a much smaller Harbor Seal. ▼

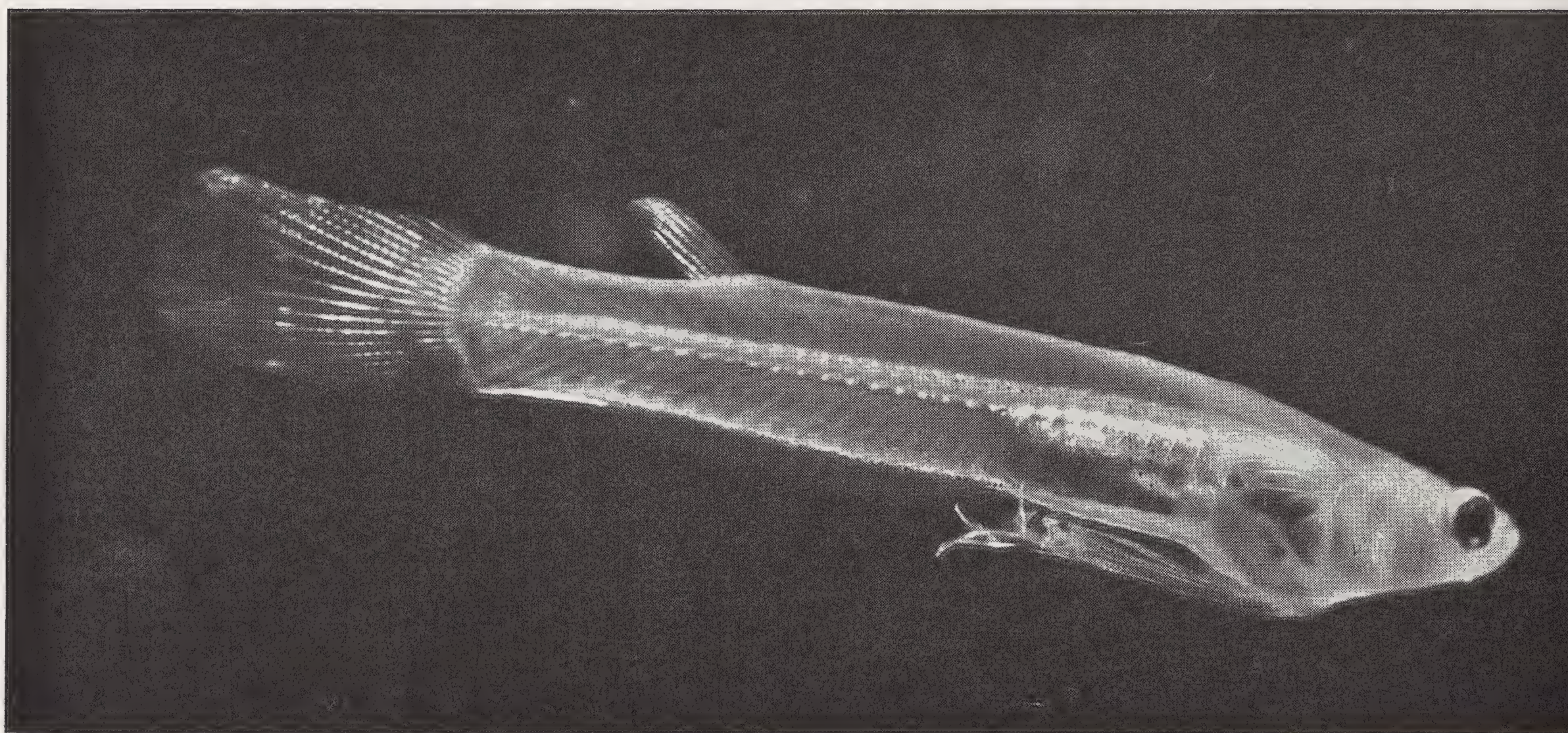


▲ Bright-eyed and healthy, this baby Congo Potto is being reared by hand in the Animal Hospital, and is gaining weight.

THOSE PUZZLING

"LITTLE TOMS"

By MYRON GORDON



ON A DAY early in June of 1954 I received a telephone call from Herbert R. Axelrod, at that time an official of the World-Wide Aquarium Supply Company of New York, who requested aid in identifying some curious, inch-long, semi-transparent fish that had been shipped up from South America.

"We aren't interested in them," he said. "They aren't colorful and they have no commercial value. They're very delicate; I've just a single live pair left out of a hundred or more. You can have them all, dead and alive. I'm just curious to know what they are."

The Genetics Laboratory of the Aquarium gets many inquiries like that and I took the call as routine and agreed to accept the fish.

That afternoon Mr. Axelrod came in with two pint cardboard coffee containers. One was marked "Live," the other "Frozen." I poured the live

fish into a small, oblong glass observation jar and looked closely at the tiny, translucent slivers that swam in a peculiar way. Although they were only an inch long, they were adults and a pair. The thinner one resembled the males of such live-bearing fishes as guppies and platyfishes in one trait — the peculiar makeup of the anal fin. It originated just behind the head and continued close to and parallel to the body to about a third of the fish's entire length, and extending from the end of the fin was a pair of antler-like processes. To an ichthyologist, such a fin is unusual — to say the least — and my mind flashed back to a picture of such an organ I had seen not long before. Donn Rosen, an associate in the Genetics Laboratory, had made drawings of the variously-constructed anal fins of live-bearing fishes for our study of the functions of these organs. The males do not use their anal fins for

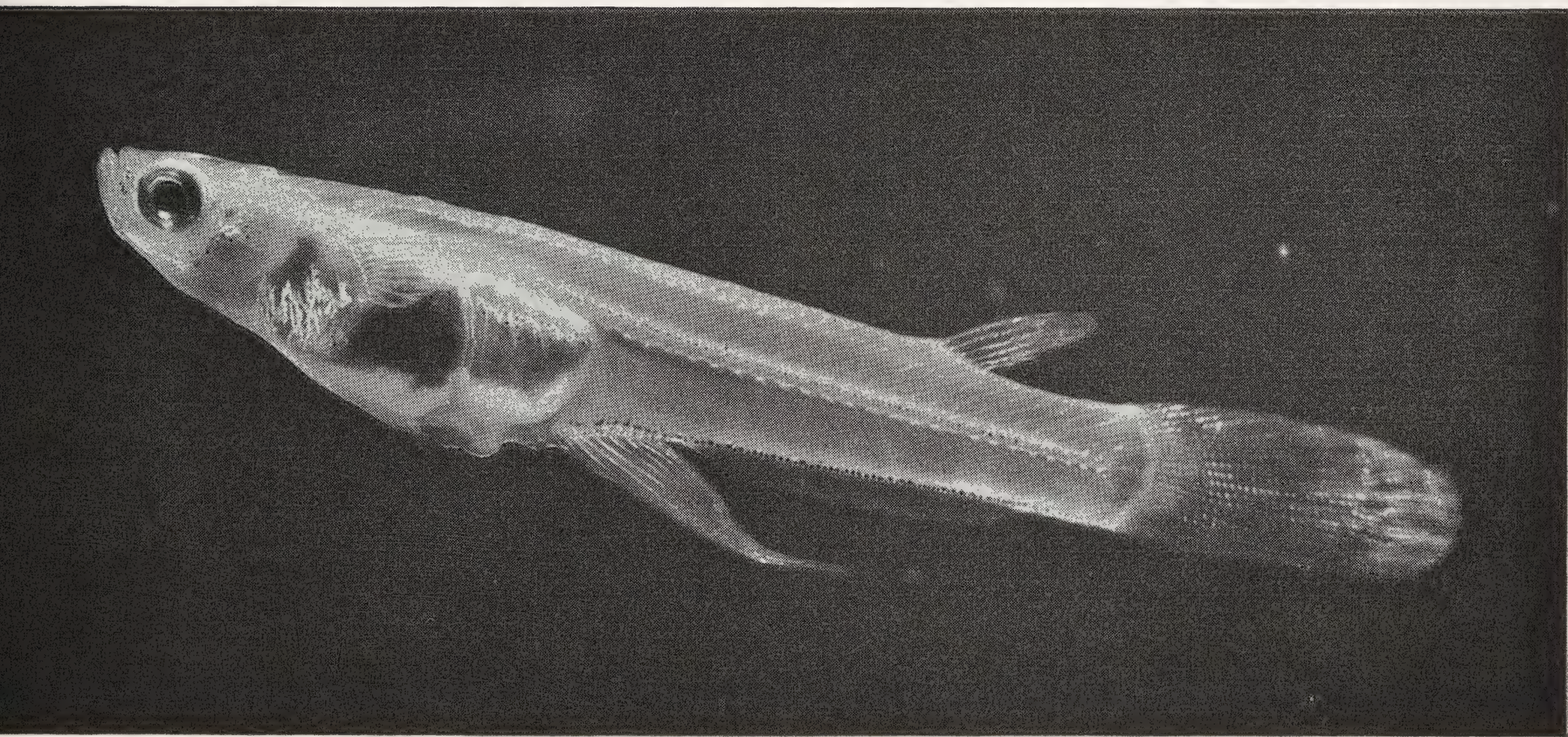
swimming but rather for transferring sperm to the females during mating. Because of this specialized function the anal fins of males are called gonopodia, sexual appendages.

I took down the Zoological Society's scientific journal *Zoologica* for 1953 and found what I was looking for in our Text-figure 41. The legend said in part: "Distal tip of the gonopodium of *Tomeurus gracilis* Eigenmann."

"That's it," I said to the fish importer. "Your fish is a *Tomeurus*; there isn't another in the world with an anal fin like that. Our drawing

American rivers, like those of Venezuela and British Guiana. Certainly they were known from those parts of the world.

On a hunch I decided to do two things. I lowered the level of the water of an aquarium to about four inches. This would give them a large surface area in relation to the volume of water. Then I dissolved two heaping teaspoons of coarse, pure table salt in a small quantity of water and poured it into the aquarium. If they were inhabitants of the waters where sea and river meet, a bit of salt would make them feel at home.



was made from a pickled specimen in the Museum of Zoology of the University of Michigan. Hardly anything is known about its manner of life, but it's reported that the female *Tomeurus* doesn't give birth to living young, as you might expect. It's supposed to lay one egg at a time. As far as I know these are the only living *Tomeurus* in the United States."

"That's right," the importer said. "I gave a pair each to two aquarist friends of mine, but they couldn't keep them alive. This is the last pair. But how are you going to keep them?"

I glanced at the tiny fish again. They kept near the surface, swimming in a way that was peculiar for fish so small — in a sinuous fashion like eels or aquatic snakes. I got the impression that this surface swimming might be associated with a pelagic existence in large bodies of water; they might frequent the broad estuaries of South

The male *Tomeurus* at the left has its anal fin folded against the body; the female is at the right. These tiny fish are only about an inch long, and their slender bodies are transparent.

Once the pair was settled in the shallow waters of an aquarium I gave them a thimbleful of live daphnia. They quickly went after these tiny aquatic crustaceans, lifting their heads in a peculiar way and revealing surprisingly large mouths. The important thing was that they were eating. I sprinkled a pinch of pulverized fish food on the water, and they picked it from the surface film and swallowed it. For the time being I felt that I had done everything I could; the rest was up to the fish. In the meantime I ordered some dried brine shrimp eggs. The newly hatched nauplii might be one of their natural live foods.

Although I had no doubt that the fish was *Tomeurus*, it is always well to check these things. Technically, many of the live-bearing poeciliid fishes can be positively identified by examination of the males' gonopodia under the microscope, and fortunately there was plenty of material for examination in the coffee container of frozen specimens.

The fish were stuck together like anchovies in a can. As they thawed out I found to my delight that there were many males among them. Their antler-like anal fins protruded at grotesque angles and it took some delicate manipulating to detach them. The first glance under the binocular microscope revealed an amazing mechanism of prongs, spines, hooks, pads, and other special structures for which no names have yet been coined, and confirmed my original surmise that the fish was *Tomeurus*. Its anal fin was as unique and diagnostic as a fingerprint. When the frozen mass was fully sorted, I had more than a hundred specimens, including fully developed males and females and a goodly number of immature fishes. Surprisingly there were seven embryos not yet hatched from the egg. Their eyes were well formed but hidden beneath the wisps of transparent tails coiled around their bodies.

Finding seven dead embryos well along in their development was puzzling. I could not remember another instance of embryos being collected with their parents. Furthermore, the embryos, still within their eggs, were attached by filamentous tissues to the gonopodia of the males.

I let my imagination take over. Was it possible that the complex anal fin of the male was used as a sort of grappling organ, to seize the egg by the mass of sticky attached threads just as it was expelled from the female? Such behavior would presuppose some sort of preliminary courtship and coordinated mating performance. Of the mating habits of the adults nothing was known. The idea that the gonopodium was a sort of a basket to catch, to hold and carry the developing egg until the embryo was ready to hatch was, I admitted, fantastic. But it had one virtue: it would explain why the fertilized eggs and embryos were found attached to large males.

On the third day after their arrival in my lab-

oratory, the "Little Toms" looked better than on the second day. On the seventh I was surprised to find a single embryo in its egg, floating on the surface. The embryo was dead. That was unfortunate, but the pair apparently had bred, and might breed again. Every day I inspected the aquarium carefully, but found no more eggs.

During July and August I had to be away. I left the Little Toms in the care of an assistant with instructions to observe them carefully and feed them on their special diet of daphnia, dried food and brine shrimp. At the end of the summer the two little fish were fatter, but no one had seen another egg or embryo.

Then one day I noticed that the female's belly bulged lop-sidedly. Since she was as pert as ever I suspected her of carrying an unreleased egg. Next day she was her trim self again, so I searched for the egg she might have shed. Nothing. Maddeningly, during the days that followed, she would be alternately bulging and trim, yet we found no results of her activities. I am sure now that the pair actually bred many times during that period; we simply were not aware of what was going on and consequently never searched diligently enough for the eggs that must have been there.

At the end of November Donn Rosen returned from the army to his post as assistant in the Genetics Laboratory. One of his first questions was about our success with *Tomeurus*. Since he was interested and competent, I suggested that he take the pair of Little Toms to his section of the laboratory and watch them.

A week later he called me over to the *Tomeurus* tank and indicated a mass of aquatic plant filaments and gravel particles.

"Take the hand lens and look at that *Nitella* filament," he said, pointing to a particular strand of algae. I did so, and there it was — an egg! It was in an early stage of development, beautifully camouflaged in the slightly brown-tinted water, about an eighth of an inch in diameter and semi-transparent and amber colored. It could easily have been mistaken for a small snail.

That discovery — and the revelation that two more eggs had been deposited, one stuck to the glass of the aquarium and another among the gravel particles — confirmed our belief that this member of a live-bearing group of fishes was ac-

tually an egg-layer. All of the eggs looked clean, free of fungus and definitely alive. In one the black eyes of the developing embryo were bright, a good sign that it was healthy.

In the next few days the changes within the eggs were imperceptible. More days and then weeks went by and we became concerned because none of the eggs had hatched. They seemed as viable as the day they were found, but — they just didn't hatch. The eggs of other tropical fishes, the Medaka and Paradise Fish for example, hatched within a week; some took only two or three days. Could it be that the eggs of the Little Toms required a special environment?

Before making radical changes, we resolved to make a thorough inspection of one of the more advanced embryos. Under the microscope its eyes could be seen to be still covered by the tail within its cellophane-like enveloping membrane. But things were advancing; circulation of the blood had started. We decided that all the eggs needed was more time.

Finding another egg each day became routine. Mr. Rosen's curiosity was thoroughly aroused. "I'm finding eggs on plant filaments and on the glass walls and in the gravel on the floor," he said. "How does she do it? I wonder whether the male helps out?"

"You may have to get up very early in the morning to find out," I replied. "Some fish, like the Japanese Medakas, spawn just at daybreak. Maybe we can trick these Tommies into thinking it's dawn. Try covering their aquarium and then taking the cover off at your convenience. That's the way Dr. Robertson and Dr. Rugh induced Medakas to spawn on command."

Mr. Rosen went immediately to place cardboard around the *Tomeurus* aquarium, leaving only the front glass open and darkening the tank considerably. In a few hours, I supposed, he would create an artificial dawn by lifting the covers off. But it was only a matter of minutes until he was back in my office.

"Well, I just saw the female lay an egg."

"But you covered them only five minutes ago."

"I did — that's when it happened."

He went on to say that just as he finished covering the aquarium he saw the female separate herself from the male, getting as far away from him as she could. In a far corner she seemed to

be looking about, testing spots here and there by mouthing the plants, the gravel and the glass of the aquarium. Then she went into a sort of vibratory dance, twisting her body into an S-curve. She then tilted her body as if she were going to lie down on her side. Still vibrating she drifted within a quarter of an inch of her chosen spot and released her egg with some force. It struck a jagged part of the glass in the corner of the aquarium and stuck to its point of contact by many adhesive threads. The egg could be lifted out by passing a needle among those sticky threads.

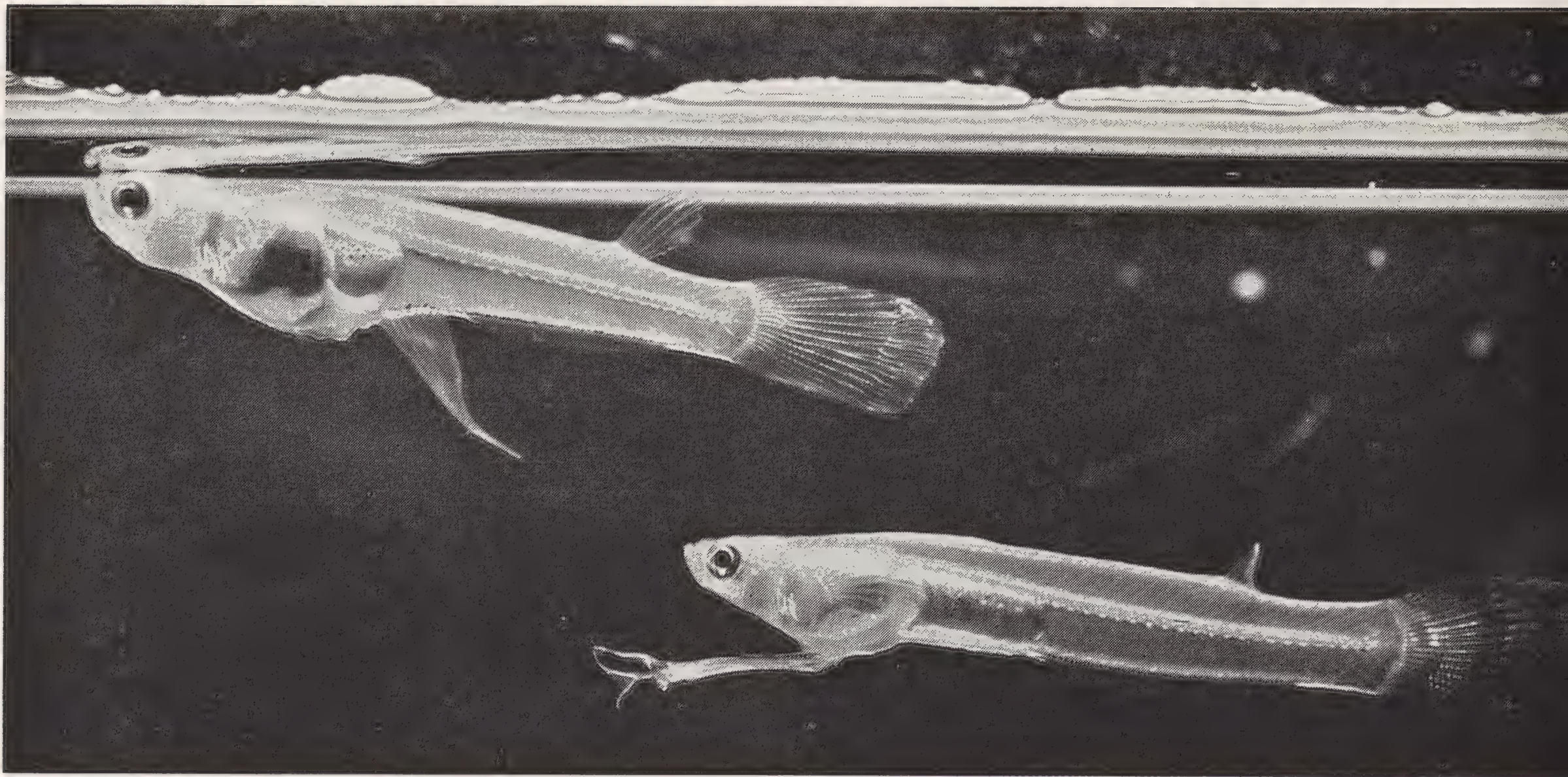
Obviously, our ideas were reversed; the Little Toms spawn at dusk rather than at dawn. And, as Mr. Rosen pointed out, their egg laying was not technically *spawning*, because the male had nothing to do with it. It was a solo performance, more like a female insect ovopositing an egg.

The next stage in discovery of the mating behavior of the fishes involved the male's use of the gonopodium — the antler-tipped anal fin. In bright light the female usually avoided her mate, but on occasions when the light was reduced by covering all but the front glass her guard was down. He lunged at her with his gonopodium thrust forward and struck her from behind and below. Instantly the water was agitated violently as the male almost leaped out of the water. If this was the consummate act in their mating performance, it was far different from that of viviparous fishes such as the platy or guppy.

Immediately following this curious behavior Mr. Rosen inspected the female. Six tiny, white, cyst-like objects were attached to her large, keel-like anal fin. He had previously noticed similar specks on that fin but assumed that they were the cysts of the protozoan *Ichthyophthyrus*, a dread disease organism known as "ich" to every keeper of tropical fish. The specks on the female *Tomeurus* always disappeared in a short time, so he gave the Little Tom no special treatment.

One of the six white spots was picked off and slipped under a microscope. Careful pressure crushed the cyst and from it flowed a stream of transparent, flagella-propelled oval objects. They were spermatozoans! The cyst was a spermatophore.

What appears to have happened is that, when the light was dim, the male attempted to make



gonopodial contact, directing the point of the anal fin so as to transfer its spermatophores to the genitalium of the female. In this instance his timing and direction were off, so that the self-sticking spermatophores were ineffectually planted on his mate's anal fin.

From December 8, 1954, to February 1, 1955, no fewer than 42 eggs were found in the aquarium. The first one hatched on January 3, having required 30 days at a water temperature of 76° F. It survived only four days. The second hatched on January 10 and lived twenty-five days. The third, fourth and fifth babies disappeared within a day.

We are a long way from knowing all the requirements of the hatchlings. Mr. Rosen thinks that they do better at 80° F. than at a lower temperature. We don't know how much salt they need in their water. We *have* learned that hatching is no guarantee of survival.

News that the Zoological Society's Genetics Laboratory was harboring living *Tomeurus* spread across the country. In September I received an inquiry about them from Dr. George S. Myers, Curator of the Natural History Museum at Stanford University in California. He said he had been trying for years to get live *Tomeurus* to complete his study of them in cooperation with Carl L. Hubbs of the University of California.

I replied that since I had only a single living pair, I did not dare risk shipping to the West

The male Tomeurus, below, has its anal fin extended, and this photograph gives some indication of the complex appendages at the tip which are used for transferring sperm.

Coast, but I offered six pairs from our preserved collection, and these he accepted.

When, last December, I reported to the staff of the Zoological Park that I had enough information to consider an article in *Animal Kingdom*, the announcement aroused James W. Atz, Assistant Curator of Fishes and the Society's bibliophile, to start searching the literature for information about *Tomeurus*, particularly its habitat and life under natural conditions. We soon discovered that very little had been published, but Mr. Atz's ingenuity suggested other sources. *Tomeurus* is found in British Guiana, and thirty-five years ago Dr. William Beebe and the staff of our Department of Tropical Research were working at Kartabo, up the Mazaruni River. Might there be references to *Tomeurus* in the unpublished field notes of Dr. Beebe, John Tee-Van and Clifford Pope, who had done much of the work on fishes? He searched the fading pages of Tee-Van's notebooks and came upon a bonanza. Apparently the field station had been much interested in *Tomeurus* and there were many references to its natural history.

To the Creole peoples of Kartabo, these little fish are known as "Lowa-lowa lice." The white

people of the region call them Sword-finned Minnows because of their conspicuous lance-like gonopodium. The local Indians have no name for them, possibly because they are of no importance as food.

Tomeurus lives in the mouth of the Essequibo River and thus is under the influence of oceanic tides. On this point, my lucky guess that the Little Toms required some salt in their water environment was correct. They swim, sometimes scores of individuals together, close to the surface. When surprised near the banks of the river or its tributaries they scoot out into open water, seeking shelter under masses of river froth, floating leaves and sticks. They feed on small winged insects and on spiders that fall and are held in the surface film. Beneath the surface they catch smaller crustaceans, such as shrimp, copepods and daphnids. Often they are trapped in backwater pools which are exposed to the tropic sun, yet the "Lowa-lowa lice" tolerate the heat. On this point Mr. Rosen was correct in his feeling that they require somewhat warmer water than we generally maintain in our tanks.

The most dramatic notes contributed by Clifford Pope were those concerning the day-by-day history of six live embryos that he obtained by squeezing them out of a gravid but dying female *Tomeurus*. They began on July 22, 1920.

23/VII/20. The female spoken of just above died yesterday, late. This morning I took her out and *easily* pressed out six eggs — all with embryos. It would appear as if they had been carried there as they were only joined to her by loose threads. Circulation in 4 is very plain; also jerking movements of the embryos.

24/VII/20. The five eggs doing well. Each is $1\frac{3}{4}$ mm. in diameter. *Tomeurus* is easily approached and the only fish of Kartabo beach that can be readily caught with a short handled net. When once in the net they spring around like little jumping jacks.

25/VII/20. Embryos developing; all five eggs alive. Examined another female *Tomeurus*. Found 3 "eggs," two clear — one a small embryo.

28/VII/20. The five eggs of *Tomeurus* (first batch) doing well. The dark blotches still growing larger and running together as are the red ones. The eggs show tendency to become translucent. The eyes (? dark bodies one on either side at one end of embryo) are very dark for first time.

30/VII/20. *T. gracilis* eggs alive.

2/VIII/20. The black of the 5 *T. gracilis* eggs is losing its intensity, continuing to become more and more like the branched red spots. The body of embryo is beginning to be differentiated. Pulsations still originate just anterior to head of embryo.

6/VIII/20. Yesterday the two eggs of *T. gracilis* in a separate dish were dry — the whole dish was dry — as I

was sick and did not attend to it. One egg was alive and is still so today, the other I threw out today. Two of the five also were not good this morning and I threw them out.

7/VIII/20. Last one of the two *T. gracilis* eggs doing well.

21/VIII/20. Getting ready to leave. The last of the 6 *T. gracilis* eggs is apparently about to hatch.

Pope's observations throw a revealing light on *Tomeurus*' close affinity to viviparous poeciliid fishes. Simply stated, the Little Tom female is capable of retaining within her body not only fertilized ova but well-developed embryos as well. This explains why we had found embryos among adult Little Toms in the frozen mass preserved by the fish importers. While enroute to the United States some females had apparently released their embryos and the filamentous threads attached to the eggs had become entwined about the gonopodia of the dead males. Pope's discoveries also explained why I had found a single, not-long-dead embryo in our laboratory aquarium after our pair of *Tomeurus* had been with us for only six days.

Why are the ichthyologists around the world concerned about this tiny, diaphanous fish? It is because *Tomeurus* is a biological paradox. The male has a complex anal fin elaborately designed for the transfer of sperms to insure internal fertilization — yet the female lays eggs. If the Little Toms were like all other live-bearing fishes to which they are definitely allied by many anatomical traits, the females should give birth to already-hatched living young. She doesn't, and therein lies the paradox.

The paradox will be resolved only when we learn more about the rarer live-bearing fishes and their egg-laying relatives. We are already aware that one egg-laying species, *Fundulus*, the killifish of our Atlantic coast, occasionally retains embryos within its body in the manner of live-bearers. On the opposite end of the range of variability, the live-bearing mosquito fish, *Gambusia*, of our southern states, may be made to release her embryos prematurely, and they hatch and survive. The more we consider the live-bearing and egg-laying fishes, the more we are drawn to the conclusion that viviparity and oviparity are relative terms and not necessarily mutually exclusive. *Tomeurus*, so casually presented to us, has certainly opened up interesting avenues of study.

Creatures of Sea Ice and Tundra Barrens

By KATHARINE SCHERMAN, New York
&
RICHARD S. MILLER
Biology Department, Harvard University



ON AN EXPEDITION to Bylot Island in the Canadian Eastern Arctic last summer, we became unexpectedly interested in the little ringed seal, *Phoca hispida*, of the far northern coastal waters, bays and inlets.

The study of sea mammals was not our primary aim. We had been sent by the New York Zoological Society and the Arctic Institute of North America to study the ecology of a small area of tundra barrens. We wanted to work out as far as possible the relation of plants, birds, mammals and insects to one another; their adaptation to the short, explosive Arctic spring, with its perpetual sunlight; their even more surprising adaptation to Ice Age conditions — permanently frozen ground and frequent below-freezing temperatures.

Bylot Island is about the size of Connecticut. It lies on the 73rd parallel, 450 miles north of

LEFT—The expedition rounding Button Point on the way to Akta cliff, the haunt of Murres and Kittiwakes. RIGHT—Part of the enormous nesting colonies at Akta, a spot seldom disturbed by visitors

Photographs by Axel Rosin & Katharine Scherman

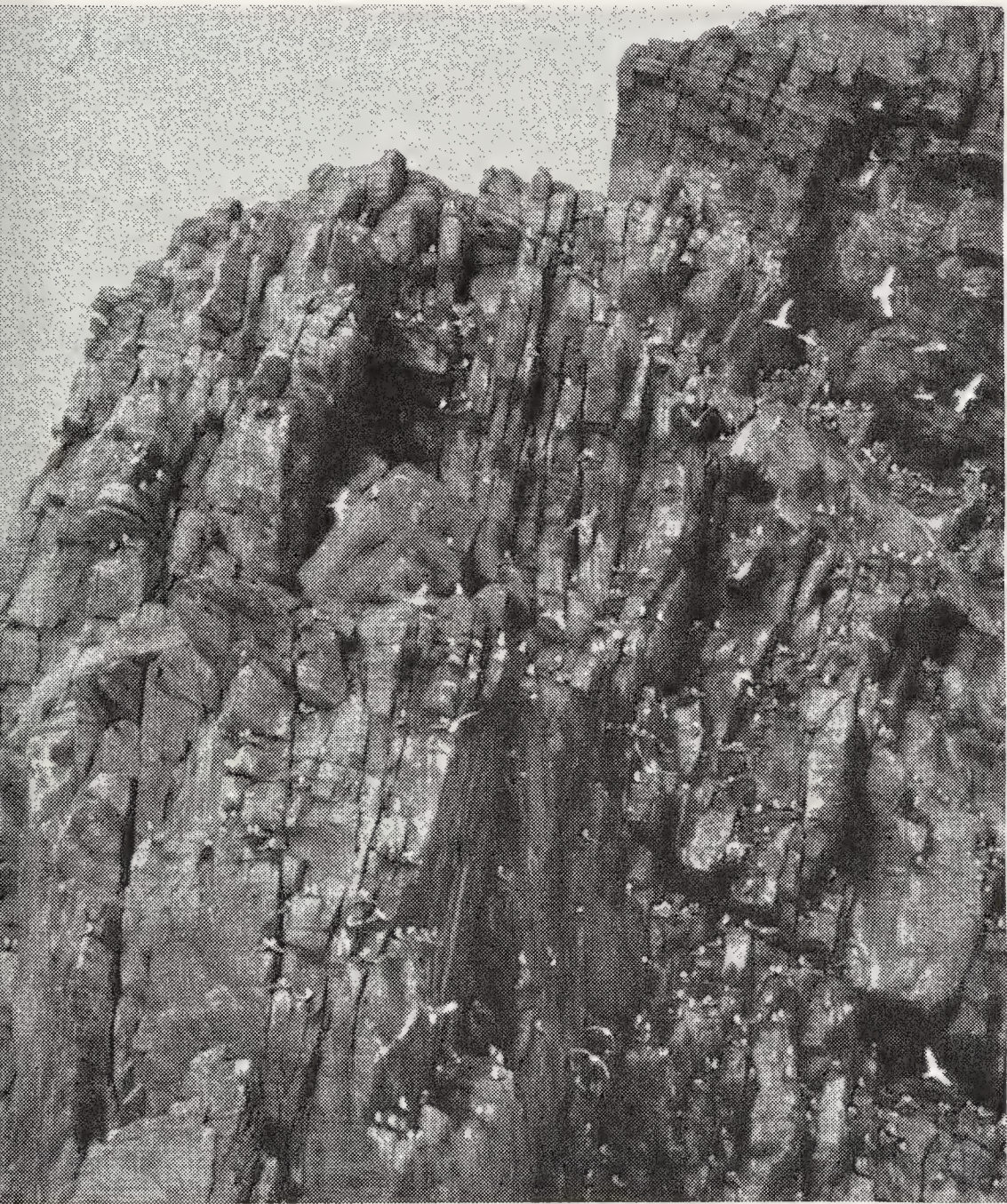
the Arctic Circle, and it is a place of tundra, glaciers and forbidding, tall, jagged mountains. In the summer it is beset by wild storms; in the winter it is closed, silent, deeply frozen. It is uninhabited by man. The farthest northern limit of Eskimo civilization in that region is north Baffin Island, twenty miles to the south across Eclipse Sound.

In June and July of 1954 we eight city-bred Americans made our invasion of this unfriendly land. We intended to make ourselves at home in a small village of tents on its cold, windy southern shore, to explore the treeless tundra that rose in gentle terraces away from the sea and to learn the ways of the dangerous, rotting sea ice, and of the creatures that lived under it.

In early June we landed by plane on the sea ice — still, happily, frozen solid — near a small settlement, Pond Inlet, on north Baffin Island. Eskimos and the seven white men (police, traders, missionaries) of this far-northern Canadian town piled us and our mountainous baggage on dog sleds and took us across the twenty miles of sea to our lonely island.

The dog sleds whispered and swayed like little

boats on a white desert on which nothing moved. Snow fell lightly, and the dark mountains of Bylot Island were shadows in the fog. But as the caravan reached its destination, the Aktineq River, on the southern shore of the island, the sun came out, low and golden, across the mountains. It was late at night, but at that latitude



the sun does not set at all from May until August. At about six in the evening it sinks to the level of the mountains and circles slowly from northwest to northeast for about eight hours. Then the ragged peaks send long shadows far out over the tundra and the sea ice, and the whole world turns pale gold. There is a chill, thin purity to the air, extraordinarily exhilarating.

Our expedition had arrived at almost the first moment of the Arctic spring. When we got there the tundra was still thinly covered with snow and it seemed a place of silence and desolation. But within a few days the snow started melting rapidly and soon the sound of rushing water was everywhere as the little rivulets opened and the big Aktineq River broke its ice barrier. The tundra quickly came alive before our eyes. And more slowly the frozen sea, cracking and rotting from the soft spring fogs and the blazing sunshine and the surging tides of the open ocean, exhibited to us its myriad life.

The first birds were just arriving. The Greater Snow Goose, which does not breed any farther south, came in great flocks to court and feed on the edges of the melting inland ponds. Shore birds — Baird's and White-rumped Sandpipers, Red Phalaropes, Ruddy Turnstones, Golden and Black-bellied Plovers — came and almost immediately set up housekeeping. Far back on the tundra we found the Rock Ptarmigan that changes its feathers, almost one by one, to accord with the changing of the tundra from snow-white to summer brown. A host of little songbirds, Snow Buntings, Northern Horned Larks, American Pipits, Lapland Longspurs, fluttered into the air as we walked, and floated gently to earth, warbling enchantingly as they warned us off their land. Old Squaw Ducks squawked in the beach lagoons continuously, night and day, like an amateur chorus — badly out of tune and never together. Huge, pale gray Glaucous Gulls circled our camp, looking for garbage. One shadowy, foggy day Arctic Terns appeared, looking like ghost-birds. This far wanderer flies an estimated 25,000 miles a year, wintering in the Antarctic and summering in the Arctic, and sees more daylight than any other living creature. An occasional Snowy Owl drifted over the tundra like a piece of fog, and Long-tailed Jaegers, beautiful, slim predators, made miserable the lives of smaller birds. On the cliffs on the ocean side of the island were thousands of nesting Kittiwakes and Murres and a sprinkling of King Eiders, Dovekies and Guillemots.

The first spring flowers were blooming in places where only a few hours earlier there had been snow. Brilliant cerise saxifrage was the earliest. As the sun warmed and thawed the top few inches of the earth, multitudes of small plants came to flower: dryas, white and wide-eyed; heavy carpets of white-flowered, red-leaved Arctic heather (*Cassiope tetragone*); Arctic poppy, yellow, long-stemmed and frail-looking, which grew where nothing else would grow and withstood wind and sleet and below-freezing temperatures; violet-blue *Erysimum pallasii* in tight, perfectly round clusters; moss pink, buttercups, lousewort, daisy fleabane. The tundra was covered with mosses and lichens in intricate patterns and subtle colors. (Some of the young birds had exact replicas of these patterns and colors in their



infant plumage). There was even a tree. It was called Arctic willow, and it generally grew about four inches high, though it can live to the age of eighty years.

Solitary bees worked busily among the blossoms. They did not swarm nor build hives; they lived in empty Lemming holes or old birds' nests, and they preserved themselves in winter by a kind of deep-freeze. Small butterflies hovered over the flowers and large, clumsy mosquitoes hatched and danced their slow circles above the warm mud of inland pools. Spiders and beetles stalked through the tiny jungles of Arctic heather and willow.

The tundra was honeycombed with the holes and passages of the multitudinous Lemming, but we saw few of them. Foxes and weasels, though we never saw them, were active in destroying birds' nests, and white Arctic Hares hopped nimbly over the melting snow.

The sea was full of life too. The gray and white Arctic Terns swooped over black open-water leads, searching for young Tom-cod. Ducks and geese fed on algae, baby shrimps and seaweed in the shallow beach lagoons. Long-tusked Narwhals paraded ponderously down the leads, and Arctic Char, a small Salmon, leaped at the river mouths.

* * *

So much for the background — the "habitat," as it were — of our expedition. The scientific re-

ABOVE—The Ringed Seal is so named because of the soft pattern of dark rings on the silvery hide. RIGHT—Pups are born usually in March or April and in the first weeks their fur is a creamy-white.

sults of our six-weeks' stay on Bylot will be presented in technical papers by other members of the party. There is room here only for an account of *Phoca hispida*, the small seal which enlivened all our trips over the sea ice.

On our first trip across Eclipse Sound, when we set up our base camp on Bylot Island, our eyes had strained through the dead whiteness, looking for anything that moved, anything alive. At that time of year, before the birds have come and the snow has melted, there is nothing to be seen in the northern wilderness — except seals. In the beginning we could not see them at all; it takes the eyes a little while to become accustomed to seeing small motion at a great distance. But in an hour or so we began to notice black specks through the fog, and soon we could distinguish form and movement. An infinitesimal head moved up and down at regular intervals; a tiny, dark, distant form was suddenly no longer there. Eclipse Sound, it appeared, was full of seals. We passed their agloos (breathing holes), slow brown whirlpools in the white ice. Occasionally we found evidences of a recent meal — a dead shrimp, left behind in a hasty departure. Once, beside a rough heap of snow, the "igloo" of a

mother seal, an Eskimo picked up a hunk of soft, yellowish fur — hair of a baby seal.

Much of what is known of the Ringed Seal comes from Eskimo observations. Since the animal is the center of their economy, these alert, wise and observant hunters have made themselves thoroughly acquainted with its life and habits. White men, neither prizing its skin nor liking the taste of its meat nor having much opportunity to study the habits of this almost inaccessible seal, have learned little of its peculiarities. We learned about *Phoca hispida* from our Eskimo friends, as had interested observers before us.

The Eskimos have an extraordinary sympathy for the little seals which are their main source of livelihood. The Ringed Seal figures importantly



graph by Ian McLaren, Fisheries Research Board of Canada

in their folklore, and the Eskimos believe that a man can become a seal (and be quite happy in that state). They believe, also, that the seal likes being killed. Death is like a little drop of cool water falling on its head. On the other hand, if the seal escapes, the Eskimo hunter murmurs a blessing over its agloo.

But with all their mystic rationalization, these hunters are remarkably keen observers. Living in a land where man is merely one amid several large predators, the Eskimo himself is part of the balance of nature, and he is as quick as an animal to sense and understand the movements of other animals.

The Ringed Seal is found all around the North

Pole, and as far south as Labrador and the Bering Sea. Apparently it has no urge either to congregate or to migrate. It seldom ventures into the open ocean but lives out its quiet, mostly solitary life in bays, fjords and inlets. In Russia and Finland there are Ringed Seals in freshwater lakes; they also occur in Hudson Bay.

Early whalers looked curiously, but not covetously, at the little creatures dotted over the ice of straits and sounds, far from the storms and predators of the open ocean. They called them "ice rats" because of their small size (adult males do not exceed six feet). And they noted that the Eskimos of Greenland and the Canadian Eastern Arctic used them for nearly every household purpose. The "ice rats," difficult to catch and lacking the soft inner fur of the Alaskan Fur Seal, never excited commercial greed. Consequently their population has remained fairly stable throughout their range.

They were classified in the family Phocidae, which includes the Harbor Seal, Alaskan Ribbon Seal and Greenland Harp Seal. This particular *Phoca* was at one time dubbed *Phoca foetida*, because of the peculiarly unpleasant odor of the old males. The Eskimos call these old males "tiggak" — stinker.

"When brought into a hut, and cut up on its floor," wrote one 19th century observer, "such a seal emits a smell resembling something between that of asafoetida and onions, almost insupportable to strangers." Eskimos, however, eat them without a grimace.

Today they are known scientifically by a more respectable name, *Phoca hispida* (rough-haired). The common name, Ringed Seal, refers to the soft pattern of dark rings on the silvery hide.

The seal mother commonly has one pup a year, born in March or April. To prepare for its coming she digs a hollow between the sea ice and the snow which lies on it. This has no entrance from above, but a passageway under the snow leads to her breathing hole, so that the mother seal can come and go in the water without disclosing her nest.

At birth the pup weighs four to six pounds. For the first weeks of its life it lives entirely on extremely rich milk — the fat content of the related Gray Seal is reported to be greater than that of elephant milk, previously thought to be the

richest. The pup gains weight and size rapidly, and by the time it is ready to feed itself, at about four weeks, it is nearly three feet long and owns a heavy layer of fat. Actually, when it becomes adult, fat and hide will make up about two-fifths of its weight. At about four weeks the baby fur begins to give way to the adolescent hide known commercially as "silverjar," coarse-textured and subtly shaded, pale silver and darker silver, with the rings a shadowy pattern on the back, fading out entirely on the belly.

At this stage the mother takes her baby into the water, teaching it to swim and by example showing it the food that seals eat. Soon after that she leaves her pup. Ringed Seals do not gather in colonies. But the young, frightened at being left alone, sometimes draw together in small groups for a little while, living off their own fat, and complaining. Soon, however, they discover that shrimps are easy to catch, and later they realize that Tom-cod and Sculpin taste quite as good as milk, and that the sharp cusps on their tricuspid molars are useful for holding fish. Then they no longer need one another's company.

Phoca hispida, in common with other true seals, is remarkably well adapted to life which is carried on almost entirely under water. When the seal goes below the surface it *exhales* before diving (a human being *inhales* before diving). As it sinks the seal's normal surface heart-beat of about 150 a minute drops to ten. The oxygen content of the body decreases from 20% to 2% in the course of the dive, a condition that prevents the "bends." In this (to human beings) extremely low physical condition, it functions perfectly, swims fast, hunts its food, escapes its enemies. Under water its ears and nostrils are closed. It uses its eyes to some extent — they are adapted both to underwater and surface vision — but its whiskers are probably of great importance at this time, too. Large, sensitive nerves attached to the whiskers probably enable the seal to feel vibration. As tactile organs they may show it where its food lies, giving warning when enemies approach, even tell it when it has reached the surface. There is on record an old, totally blind Gray Seal that when captured was healthy and had a full stomach, indicating that some sense other than sight is operative.

After fifteen minutes the seal must come up

for air. As soon as its nose is in the air it takes deep breaths. The carbon dioxide is exhaled and normal metabolism is restored within a few seconds.

During winter and spring, when the bays and inlets are frozen, the seal uses breathing holes, about three feet in diameter. Eskimos say seals can cut these holes with the sharp claws on their flippers through six feet of solid ice. It is also probable that they begin making breathing holes when the first thin film of ice forms, and keep them open simply by using them.

If the seal feels sleepy and replete it reclines on the ice beside its agloo. Its heavy layer of fat allows it to lie for hours on the ice without any loss of body heat. But even while apparently asleep it is alert. About every thirty seconds its head goes up, seemingly unconsciously, and it searches the sea ice for danger, using both nose and eyes. Although its eyes are said not to be very efficient, it is apparently extremely alert to motion. A wary seal will sometimes dive when a hunter is still a quarter of a mile away.

Phoca hispida has few enemies. The Polar Bear stalks it silently on the winter ice (in the summer the bear follows the pack ice on the open ocean, far away from the haunts of the coast-loving Ringed Seal. The Arctic Fox occasionally takes a pup in the early spring. In late July tribes of Killer Whales enter the straits and inlets, wantonly killing everything in sight. These creatures eat voraciously. The stomach of one Killer Whale was found to contain thirteen porpoises and fourteen seals — though the animal was less than twenty feet long! Another had twenty-four seals inside it, and had choked while trying to eat the twenty-fifth.

The little seals scatter before these killers, often clambering up on shore, even into an Eskimo village, to escape the dreaded enemy. A seal has been known to dive between a man's legs and stay there, trembling with fear, while the Killer Whales caroused in the water. But Killer Whales do not often come into inland waters. And even when they do, the Ringed Seals are not murdered *en masse*, since they do not colonize.

The chief enemy of the little seal is man. Since the virtual extermination of the immense Caribou herds of the Canadian Eastern Arctic the Eskimos there have centered their economy on

Phoca hispida. The pretty and abundant little creatures provide food for people and dogs, skins for clothing, leather for boots and dog traces, fuel for the huge soapstone cooking lamps and the smaller lighting lamps. An Eskimo hunter has estimated that he must take two hundred seals a year to feed and equip his family and animals. In the summer he can take a few Narwhals and an occasional Walrus or Bearded Seal. In the winter and early spring he sometimes gets a Polar Bear. But his main source of livelihood is the Ringed Seal. It also has a small commercial value in Canada. A sealskin brings from fifty cents to three dollars at the Hudson's Bay Company trading posts, depending on the age and condition of the skin.

There is, at the moment, no danger of extermination of the Ringed Seal. There are not many Eskimos in the far northern, inhospitable places where *Phoca hispida* thrives. And even if the hunters wanted to, they could not go on orgies of killing. The seal leads a solitary life and is extremely wary and difficult to hunt. In the dark, bitter winter the hunter must stand for many hours over a seal agloo. His family, even the littlest children, guard other breathing holes on the ice. If the seal shows its nose they drive it down, until it must finally, sometimes after a whole day, come up where the hunter's harpoon is poised. In the spring the Eskimo stalks the

seal over the ice, creeping behind his white seal shield. Often the cautious and sensitive animal notices even the slow motion of the shield. Then the hunter must lie on the ice and clap his feet together, raising his head up and down as if he were just another seal, to soothe the nervous animal. If he can get close enough to shoot his aim must be perfect. For if the seal is only wounded, even mortally, it will exhale, dive into its agloo and sink instantly. Later in the spring the Eskimo hunts along open-water leads — and here again his aim must be perfect. After he has shot the seal in open water he must harpoon it immediately to pull it up on the ice, because even a dead seal sinks within a few minutes. Needless to say the Eskimo hunter does not waste expensive ammunition on random shots, so few seals are lost through careless wounding.

Though man is its chief enemy, men in the far north are both too few and too wise to be a serious threat to the Ringed Seal. The gentle and wary mammal, scattered and solitary, hunted by few, consequently leads a remarkably calm life. Nature has equipped it to have but one pup a year, so the population stays at a level in keeping with the slim food supply of these frigid waters. In the frugal world of the north, which abounds neither in predators nor victims, *Phoca hispida* exists in perfect harmony with its surroundings, absolutely adapted to its icy world.

News from the Conservation Foundation

Job Possibility Survey

During the last few years the Conservation Foundation has been directly responsible for the establishment of one graduate training program in conservation and has been closely associated with the development of several others. During this same period we have received innumerable requests for guidance in conservation training and employment from individuals interested in the field. A systematic study of the sorts of positions which are now available and which

might be developed has just been initiated under the direction of Mr. Roger Hale. Mr. Hale's many years of business experience, with his specialized training in the Yale Conservation Program, give him an unusually satisfactory background for such a study. He will analyze the product of the various institutions now giving graduate training in conservation and in addition will study the market for such individuals in business, industry and government. A report on the findings of this study will be completed by the end of the year.

Eastern Water Law

An analysis of the water problem in the eastern part of the United States has just been begun by the research division. This study will examine the various factors involved in the legal control of water by various states. Over the last few years there has been considerable agitation for changes in water law. The emphasis of this study will be on legal analysis and the bearing of laws on economic development. Since the solutions may be achieved through administrative change, through engineering development, or simply through better use of water as well as through legal change, all of the facets of the problem will be examined.

The entire project is under the direction of Mr. Stephen Bergen, a member of the Research Department staff. The legal analysis is being conducted by Professor David Haber of Yale Law School. The ultimate scope of the study and its form of publication will be reported later.

Bighorn Sheep Project

Excellent progress reports are coming in from Dr. Helmut K. Buechner, who is in charge of the current study of the splendid animals often spoken of as "Rocky Mountain" Sheep. A recent letter speaks of an aerial census he made of Bighorns in the Yellowstone region on Thursday, February 10, at a temperature of 19° below zero.

He counted 189 animals from the air and added three more seen on the ground the following day. His letter ends with the statement, "I am repeatedly thrilled with the fine project I have before me." Our great hope is that this study of all Bighorns from the Canadian to the Mexican Border will contribute to a clearer understanding of ways to ensure their long-term protection.

Conservation Achievement by Industry

The Audio-Visual Department is collecting examples of industrial achievement in the field of conservation for potential film, book and other educational purposes.

Some sixty stories have already been received from eleven leading industries and the Manufacturing Chemists' Association, and more are expected to be made available for review and evaluation.

Fifty Years of Forestry

The Conservation Foundation was fortunate in being one of ten institutional sponsors of the Fiftieth Anniversary Dinner of the U. S. Forest Service held in Washington on February 4. President Osborn represented the Foundation at the meeting. The program, in which most conservation leaders participated, emphasized the high professional standards of the Forest Service and noted the progress which this important conservation agency has made.

BEHIND THE SCENES

**NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH**

How Many Bear Cubs?

Any time in the next week or two we expect to see the first excursions of our Black Bear cubs — and to learn definitely how many we have. Keeper Joe Ruff heard infant squalls in the mother's rocky den on the morning of January 31, and a few days later the mother emerged with one cub in her mouth. She drank at the pool and carried the cub back to the den. The following day she came out with two cubs and the

keeper believes he could distinguish the sound of one cub inside while the two were with their mother. We will know whether we have two, or three, only when they are large enough to come out under their own power. — W. Br.

President Osborn Honored

President Fairfield Osborn has been informed that by action of the King of the Belgians he has been made a member of the Institut des Parcs Nationaux du Congo Belge.



A litter of African Puff Adders born in the Reptile House collection on Feb. 28. There were 28 alive and 2 dead, and the youngsters (6 or 7 inches long) are thriving. Several of them will be presented to other zoos.

It's Baby Time, All Right

In one 10-days' period in mid-March we acquired eleven animals by birth — not a record for a comparable period, but not bad for a preview of the spring season in the Zoo. The newcomers included seven Mouflon and one each of Aoudad, Blue Duiker, Blackbuck and Llama. The latter, born on St. Patrick's Day and inevitably named Patricia, is probably going to be one of the stars of the Children's Zoo.

We Have Another Callimico

Last December we received what appears to be the first Callimico or Goeldi's "Marmoset" ever exhibited outside its native South America. Being so rare in zoological collections, it could hardly be expected to turn up again in a few months — but it has.

Our first specimen was not in very good condition when it arrived, and it died on January 21. It was of such considerable interest that it was sent to Dr. G. E. Erikson of the Harvard Medical School for external examination and was subsequently sent by air to Dr. W. C. Osman Hill, Prosector of the Zoological Society of London, for still more detailed anatomical studies and reporting in a later volume of his work on the Primates.

Unexpectedly, on March 1, we were able to acquire a second specimen of this rare primate. It is lively and vigorous and is currently being cared for in the Animal Nursery. — W. Br.

Special Train to the Zoo

The New Haven Railroad will run a special "Zoo Train" to the Zoological Park on April 16 from Springfield, New Haven and Bridgeport. If the experiment is successful, similar special trains will be run during the summer.

"Let's Litter Less"

The anti-litter posters, "Let's Litter Less," designed by the Zoological Park and put up for the first time last fall, have attracted national attention. The "Keep America Beautiful" Association has reproduced one poster which is being widely distributed by the Garden Club of America and there have been many requests for samples and sets of the nine posters.

PUBLICATIONS OF INTEREST

AMPHIBIANS AND REPTILES OF WESTERN NORTH AMERICA. By Robert C. Stebbins. Pp. xxii + 529, 104 pls. and 52 figs. McGraw-Hill Book Company, Inc., New York, 1954. \$8.50.

All students of North American herpetology, but especially those residing in the western part of the country, will welcome this excellent book by Professor Stebbins of the University of California. Here is a comprehensive book covering all species of amphibians and reptiles found in western North America — the area west of the eastern boundaries of Mackenzie, Saskatchewan, Montana, Wyoming, Colorado and New Mexico. The book is illustrated thoroughly by the skilled sketches of the author and includes at least one illustration of every form and a complete distribution map for

each species. The treatment is by species with subspecies being considered under the section on distribution at the end of each major group. The emphasis is on identification but Stebbins is an able field naturalist and includes a summary of the known habits for each species, including many of his personal field observations. This is a grand reference for amateur and professional alike. — J.A.O.

THE WATERFOWL OF THE WORLD. By Jean Delacour. Sixteen plates in color by Peter Scott and thirty-three maps. Vol. I. Country Life Ltd., London, 1954. £5.5s (app. \$15.00).

While there have been many publications covering the swans, geese and ducks in part, it seems rather curious that up to this time no complete coverage of the group, of the magnitude of the present work, has been attempted. This, perhaps, may be as well, for the combined experience of author and artist with waterfowl in nature, in the museum specimen case and in captivity, could hardly be matched. Following the reorganization of waterfowl systematics advanced by himself and Dr. Ernst Mayr in the *Wilson Bulletin*, 1945, the author has covered, in this first volume of a projected set of three, the Magpie Goose, the Whistling or Tree Ducks, the Swans, the true Geese and some

others, including the Sheldgeese or Upland Geese, the Shelducks and the Steamer Ducks. Under each group, species and race will be found description, distribution and an account of habits in the wild and in captivity. Peter Scott's illustrations are so superbly done and perfectly reproduced that the smallest racial differences are readily discernable. The two volumes to come will be eagerly awaited. — L.S.C.

MARLIN PERKINS' ZOOPARADE. By Marlin Perkins. Endpapers and sixteen full-page plates in color by Paul Bransom and numerous black and white drawings by Seymour Tleishman. Pp 96. Rand McNally & Co., Chicago, New York and San Francisco. \$2.95.

In this attractive volume the author uses the technique so successful in his popular television program of the same title. A living animal or a pleasing drawing catches the eye of viewer or reader, an anecdote or two holds his attention and before he can drift away, he has been exposed to more natural history information than might otherwise have reached him. In twenty-two short chapters, Mr. Perkins introduces as many kinds of mammals, most of them well known to television watchers or zoo visitors. Paul Bransom's lovely paintings add much of interest and Mr. Tleishman's drawing are adequate. — L.S.C.

New Members of the New York Zoological Society

(Between January 1 and February 28, 1955)

Benefactor

John H. Phipps
David Rockefeller

Founder

Dr. Henry Clay Frick
Gilbert W. Kahn

Patron

Miss Anne Phipps

Life

Robert E. Blum
Mrs. Ebben Schramm Llewellyn
Mrs. Bernard Peyton, Jr.
DeWitt Wallace
Mrs. DeWitt Wallace

Contributing

George Payne Bent, II
Mrs. D. Fairfax Bush
George A. Chamberlain
Mrs. William L. Chenery
Miss Ruth Auchincloss Child
George Clausen
Mrs. W. Murray Crane
Mrs. Livingston Cromwell
Miss Linda Darnell
Coleman duPont Donaldson
Duncan S. Ellsworth
Mrs. F. Sheffield Faulkner
Dr. F. Gudernatsch
Dr. Robert H. Halsey
O'Donnell Iselin
Frederick W. Jackson
Frederick P. King

Mrs. George W. Kosmak
Mrs. Clifford D. Mallory
William H. Mathers
Walter Mendelsohn
William Miloscia
Mrs. Louis deB. Moore
John M. Morehead
Gustaf A. Nyden
George W. Perkins
Warwick Potter
Auguste G. Pratt
Otto H. Reisser
Mrs. M. Roessel
Mrs. E. Schelling
Thomas L. Smith
Mrs. Andrew V. Stout
Harvey M. Thomas
Mrs. Jeannette Watson
Mrs. John J. Weber
Samuel A. Welldon
Mrs. William P. Willetts
Morrie R. Yohai

Annual

Alfred Reginald Allen
Mrs. Reginald Barclay
Miss Ellen E. Black
Mrs. Adolphe Boissevain
Dr. George Brown
Mrs. Francis H. Cabot, Jr.
Mrs. Hawley T. Chester
Dr. L. R. Christensen
Morris Cohen
Mrs. Dorothy E. Connell
Mrs. Edgar M. Cullman

Mrs. William R. Deering
Charles Marden Fitch
Miss Gladys M. Freeman
John Galm
Carroll Gilleran
E. Godfrey
Mervin J. Goldin
Simon Gross
Mrs. Helen W. Hansen
Mrs. Cora A. Hull
Miss Ruth W. Jones
Robert M. Kelly
Mrs. Henry G. Laykind
Philip K. Levy
Mrs. Walter S. Mack
Mrs. William C. Mayer
Master Daniel Metraux
Henry W. Metzler
Gerard L. Moench
Frank J. Muhlfeld, Jr.
Ector O. Munn
Mrs. Stone Philipp
Miss Adelaide I. Richter
Rocco Rosato
Mrs. Arthur Rous
Mario A. Ruffolo
Charles B. Sackett
William R. Saner
Mrs. Philip S. Sears
Ellison Ward Smith
Mrs. DeWitt Stetten
David B. Stone
John D. Warren
George J. Wilder
Stanley Wolf



“YOU WOULDN'T BE RUSHING IT A TRIFLE?”

RIGHT BACK THERE in a February cold spell our penguin Annie* and his girl friend George* gathered some old pieces of cellophane about their feet and became parents of an egg.

Certain outsiders considered this performance a bit premature, but George and Annie knew what they were doing. If the egg cooperates we may have a fuzzy young penguin to greet you on your first spring trip to the Zoo.

George and Annie and all the rest of us have been busy for weeks getting ready for spring —

now almost a matter of hours away. It will find us all spick and span and ready for your entertainment, with many new exhibits besides the potential baby penguin.

Oh, by the way, we will guarantee to supply you with the new exhibits if you will get us some new members for the Society. We need them. Just use the card bound in this magazine, or write or telephone their names, or better still — sign them up yourself.

MEMBERSHIP DEPARTMENT
New York Zoological Society
30 East 40th Street
New York 16, New York

SO YOU'RE GOING TO THE ZOO! HERE'S HOW TO GET THERE —

AUTOMOBILE. *From east New York City and Long Island:* East River Drive N. across Triboro Bridge; Northeast on Bruckner Blvd. to Bronx River Parkway; North to Exit 5 for Bronxdale Parking Field of Zoo, or Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field.

From Long Island: Across Bronx-Whitestone Bridge, continue on Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), thence W. to Zoo.

From west New York City and New Jersey via tunnels: Henry Hudson Pkwy. N. to Dyckman St. and Broadway; N. on B'way to 207th St.; turn E. on 207th St., Fordham Rd. and Pelham Pkwy. to Zoo.

From New Jersey via George Washington Bridge: Through tunnel at east end of bridge, up ramp marked “Bronx-Bronx Whitestone Bridge,” E. to University Ave., N. on University to Fordham Rd., E. on Fordham to Zoo.

From Westchester and Connecticut: Merritt Pkwy. S. to Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), OR Bronx River Pkwy. S. to Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field, or Exit 5 for Bronxdale Parking Field.

From western Westchester and upstate: Sawmill River Pkwy. S. to Mosholu Pkwy., skirt Botanical Garden southward to Pelham Pkwy., turn left to Pelham Pkwy. gate and Fountain Circle Parking Field.

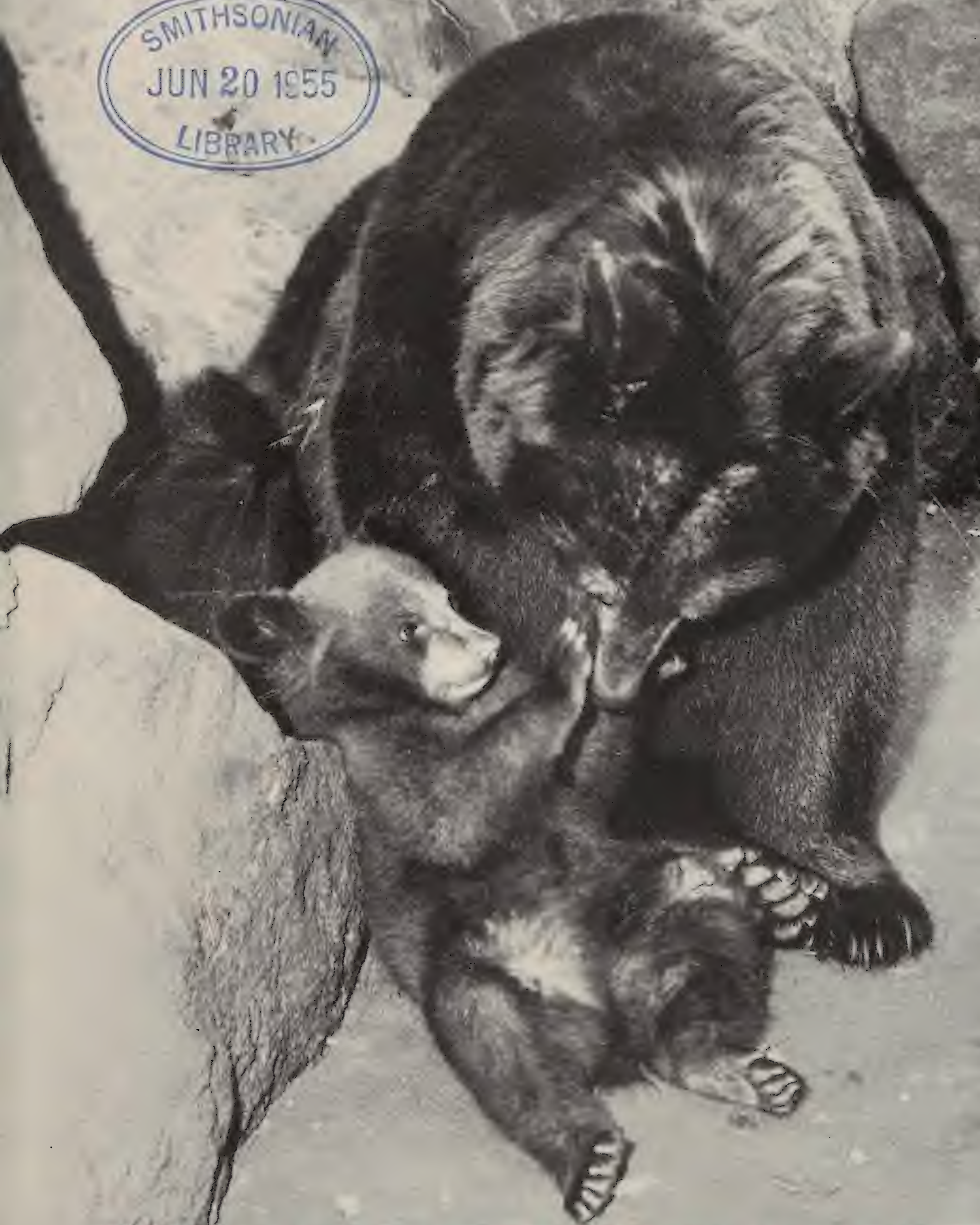
SUBWAY. *West Side (IRT):* Northbound East 180th St. Express to 177th St. Walk N. to Zoo.

East Side (IRT): Northbound 241st St.-White Plains Rd. Express OR East 180th St. Express to 177th St. Walk N. to Zoo.



590.673
.A59

ANIMAL KINGDOM



NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT Fairfield Osborn	VICE-PRESIDENTS Alfred Ely Laurance S. Rockefeller Donald T. Carlisle	SECRETARY Harold J. O'Connell	TREASURER David H. McAlpin
		ASSISTANT TREASURER Percy Chubb, 2nd	

EXECUTIVE COMMITTEE

Laurance S. Rockefeller <i>Chairman</i>	<i>Class of 1956</i> Archibald S. Alexander A. Raymond Dochez Robert G. Goelet De Forest Grant Eugene Holman Warren Kinney William De Forest Manice Harold J. O'Connell Landon K. Thorne J. Watson Webb
John Elliott Alfred Ely Robert G. Goelet De Forest Grant Warren Kinney David H. McAlpin Robert Moses Harold J. O'Connell Fairfield Osborn	

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

BOARD OF TRUSTEES

<i>Class of 1957</i> Robert E. Blum Percy Chubb, 2nd C. Suydam Cutting Alfred Ely Marshall Field Childs Frick Henry Clay Frick Archer M. Huntington David H. McAlpin Richard C. Patterson, Jr. John H. Phipps	<i>Class of 1958</i> George F. Baker, Jr. F. Trubee Davison John Elliott Robert I. Gannon Peter Grimm Fairfield Osborn Eben Pyne Laurance S. Rockefeller Archibald Roosevelt John M. Schiff Edwin S. Webster
--	---

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Grace Davall . . . *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandall *Assistant Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch . . . *Assistant Curator, Education*
Quentin Melling Schubert *Superintendent,*
Construction and Maintenance
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. . . *Research Associate in Ichthyology*
Harry A. Charipper . . *Research Associate in Histology*
Homer W. Smith . . *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges . . . *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez Caryl P. Haskins
Alfred E. Emerson K. S. Lashley
W. A. Hagan John S. Nicholas

AFFILIATES

C. R. Carpenter, Co-ordinator
Animal Behavior Research Programs
L. Floyd Clarke, Curator
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen Samuel H. Ordway, Jr.
George E. Brewer, Jr. Hugh J. Ross
Donald T. Carlisle Robert G. Snider
John C. Gibbs Peter M. Stern

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

Black Bear Family
Sam Dunton Cover

Banana Bonanza
James A. Oliver 66

**How Birds Handle Their
Population Problem**
Alexander F. Skutch 72

**The Fish with Holes in Its
Head** *James W. Atz 77*

Black Bear Cubs at Last
Photos by Sam Dunton 80

**Nine-banded Armadillo—
Invader from the South**
G. Dale Buchanan 82

A Summer in Asia
William Beebe 89

**News from the Conservation
Foundation 90**

Behind the Scenes 91

**Wild Animals We Will
Never Know 95**

Vol. LVIII JUNE No. 3
1955

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

The Magnetism of Animals

THE OTHER DAY an enterprising real estate man tried a novel trick. Apparently he had been unsuccessful in getting a tenant for some ground floor space on one of the busiest intersections in the city. In order to illustrate the desirability of the space he put on an "animal show" comprised of a peacock, a sea lion, a goat and some monkeys, which he had borrowed from a troupe whose doleful destiny it was to make appearances on television. For a fortnight crowds of people, four and five deep, lined the windows just looking at the animals. Whether or not he gained a tenant is unknown but his experiment at least corroborated the fact that there is nothing like animals as magnets of popular interest. Somehow, it must be added, we felt sorry that the animals had been drawn into the world of business.

This little incident was in itself just another proof of the magnetism of animals, and one which, on an infinitely larger scale, is proving of value to our Society in these times. The animal world as a drawing power and as a focus of human interest is maintaining attendance at the Zoo at an annual figure of close to two and one-half million visitors a year. This is happening at a time when the attendance at most public cultural institutions has declined as compared with earlier annual averages. The fact is that considerable changes have taken place in the public's use of leisure time. For instance, there is the greatly increased ownership and use of automobiles. To some degree, in our case, this facilitates coming to the Zoo, as it will to the new Aquarium. However, on balance, it is proving an adverse factor not only to our Zoo but also to other public institutions because, on weekends and holidays, parking facilities are not adequate to meet the demand. Another change is the invasion of television in so great a number of American homes. The trend is towards people becoming "second degree" viewers rather than "first degree" participants. If it were not for these new trends in the use of leisure time, it is probable that our annual attendance would be hitting the three million mark because of the many improvements and attractions added to the Zoo in recent years.

All in all, we are holding our own in good shape as far as public attendance is concerned, a cheering fact for the Zoological Park and a highly promising one for the new Aquarium when it is opened next year.

Fairfield Osborn

JUN 13 1955

BANANA BONANZA

By JAMES A. OLIVER



THE BANANA INDUSTRY has reaped a large harvest of material wealth from its far-flung plantations in Central and South America. The benefits of this bonanza have been spread over a large area, including all of the Americas, and have taken many forms, ranging from educational institutions to an increase in mechanization of the industry. During the development of these varied activities there have

been many improvements in the methods of handling bananas to insure the delivery of tasty, ripe fruit to northern consumers. Thus the fruit is sprayed and dipped in chemical solutions before it leaves the tropics, is sealed in a protective transparent covering, travels in an air-conditioned hold of the ship, is unloaded on rubber-cushioned lifts and conveyors, and again stored at proper temperatures until delivered to the retail stores.

All of this is designed to give us properly ripened, healthy fruit.

The continuing success of this industry is attested by the recent completion in New York Harbor of the largest and best-equipped banana terminal in the world — a \$1,000,000 installation that can unload 50,000 stems a day. The new terminal insures a steady supply of mellow fruit for all of us who are fond of bananas.

But what does all this have to do with the Zoological Park? Aside from the fact that a number of our animals — and employees — are fond of bananas, we have another very real interest in the banana industry. It is the source of some of our rarest and most unusual reptiles — tree-dwelling species that are difficult to collect and seldom seen in dealers' lists. These rarities are a real bonanza for us!

In the tropics the growing banana stalks afford admirable shelter for many small, arboreal and semi-arboreal forms of animal life. These range from tiny invertebrates, such as snails and insects, to small mammals, such as the Mouse Opossums, and include a number of species of interesting reptiles. The vast majority of species habitually found in bananas are nocturnal forms that probably use the stalks as regular daytime abodes. A few diurnal forms are found occasionally. They probably forage for food around or on the bananas and seek shelter in them when frightened. All are potential passengers on a northward voyage when the stalks of bananas are cut and shipped.

In the early days of the banana industry when the fruit was shipped unsprayed and without re-

minals and warehouse storerooms. A reptile on bananas in the retail grocery store is about as rare today as a model T Ford on New York's Fifth Avenue.

It is interesting to note that chemical treatment of the bananas is given to prevent the spread of a plant disease and not primarily to discourage animal stowaways. The trees are sprayed with a solution of copper sulphate to eliminate wind-blown spores. Then to remove the copper sulphate and its greenish color from the fruit, the stems are dipped in a weak solution of muriatic acid. These chemicals not only safeguard the plants from the disease but effectively discourage animal life from remaining in the stalks.

In spite of this attention, a few animals still manage to come through alive and, while the numbers have been decreased percentage wise, the increase in quantity of bananas imported is sufficient to supply us with occasional rare specimens. Thus we received two snakes and one lizard in 1952, four snakes and one lizard in 1953 and the same numbers in 1954. The present year is a real bonanza year for us since we have already received more specimens in the first three months of the year than we did in the preceding three-year period. Apparently the hurricanes of last summer temporarily disrupted the spraying and dipping program, much to our advantage.

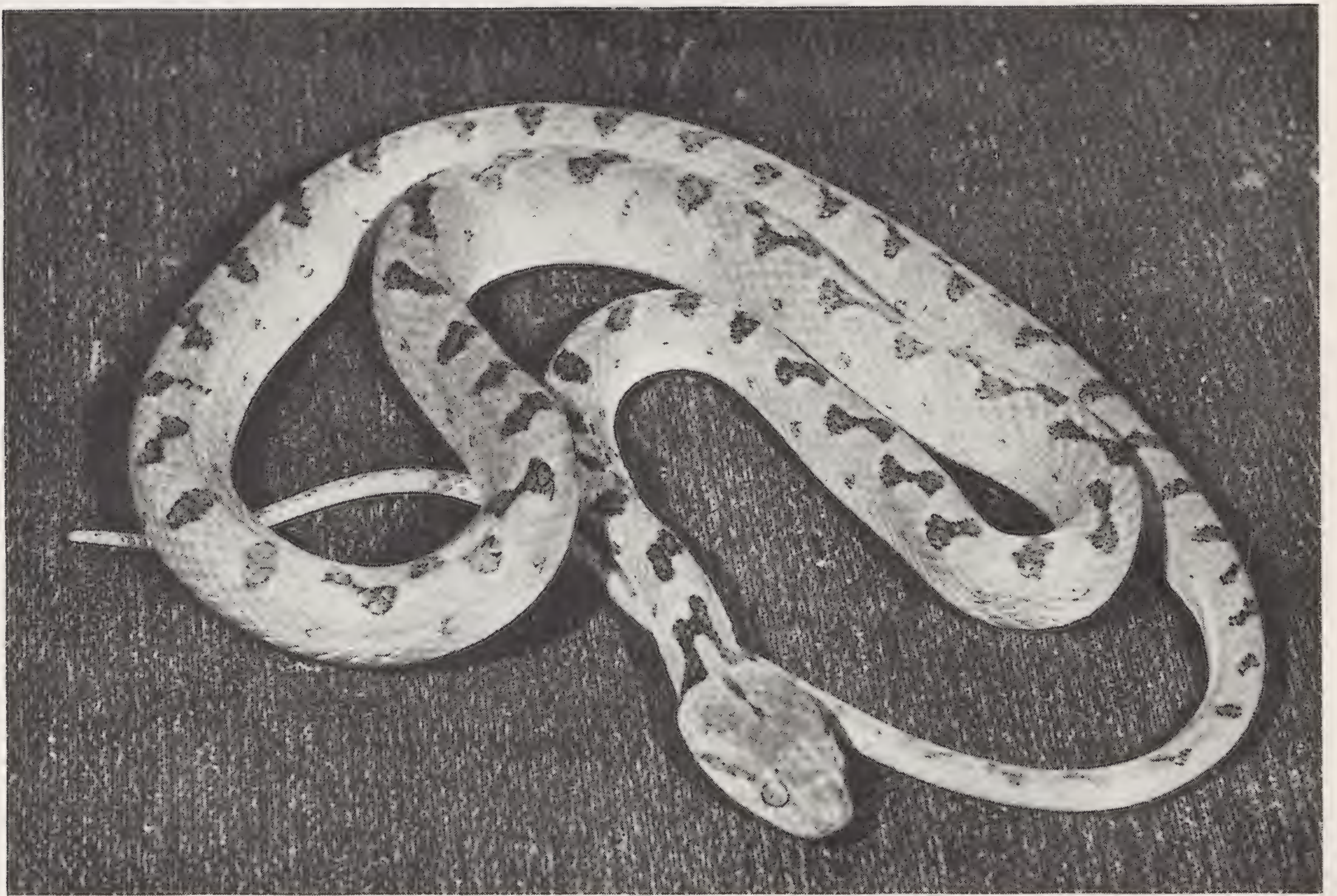
As mentioned previously, the Boa Constrictor is commonly believed to be the snake most frequently found in bananas. In the four-year period covered here we have received five small Boas — three of the Central American race and two of the South American form. However, this is only the second most frequently-found reptile inhabitant of bananas and not the first. The title of the most common banana import goes to the small Spotted Night Snake (*Leptodeira annulata*). This snake, attaining a maximum length of about 24 inches, outnumbers all others in lots that we have received. It is a hardy arboreal species and is abundant throughout Central America and northern South America. It occurs in swampy woods and wet forests, as well as the banana plantations. This is a rear-fanged snake with a weak venom that paralyzes the small frogs and lizards that make up its food. I have never seen this species attempt to bite when handled,

The Annulated Boa is rare even in the collections of natural history museums, but we received two specimens in banana shipments within a week of each other. One died, but the other is feeding well.

frigeration, the corner grocer was the primary discoverer of the animal stowaways. In the mind of the public, Tarantulas and baby Boa Constrictors occurred more naturally on bananas than anywhere else. With the use of refrigeration and chemical sprays on the bananas the imported fauna has been greatly reduced. The few individuals that occasionally slip through despite this treatment are discovered in the unloading ter-



Commonest imps
in bananas are B
Constrictors (top) c
Spotted Night Sna
(below). The lat
outnumber all othe



but the bite of closely related forms is said to produce mild discomfort similar to the sting of a Honey Bee.

The third most frequently-received reptile and the only lizard that we have obtained from this source is the Spiny-Tailed Iguana (*Ctenosaura similis*). Three specimens of this lizard have come in from lower Central America. Two were small individuals, about a foot in length, but the third one, shown in the accompanying photograph, was nearly two feet long. This is a

diurnal species that probably hides in the banana stems when alarmed or possibly crawls into cut stalks that are piled and awaiting shipment. It is, of course, a harmless creature.

Two diurnal snakes that have turned up once each in the past four years are the Tiger Rat Snake (*Spilotes pullatus*) and the Green Tree Snake (*Leptophis ahaetulla occidentalis*). Both of these were small individuals about two and a half feet in length. These are harmless species that feed on tree frogs, lizards, birds and small

mammals. Both are found on the ground as frequently as in bushes and trees.

One colorful young Tropical King Snake (*Lampropeltis doliata polyzona*) that arrived in a New York banana warehouse caused considerable excitement among the employees. One of them, an amateur herpetologist of wide experience with the local fauna but little knowledge of tropical species, was certain that the snake attractively banded with yellow, black and red was a deadly Coral Snake. With understandable trepidation he herded it into a sizeable box and secured the lid with welcome relief. His misidentification of this individual was not surprising since a number of similarly-colored harmless snakes closely resemble many of the pattern variations of the tropical Coral Snakes. The color characters so useful in distinguishing the Coral Snakes of the United States from similarly-marked harmless species are of no value south of the border of the United States.

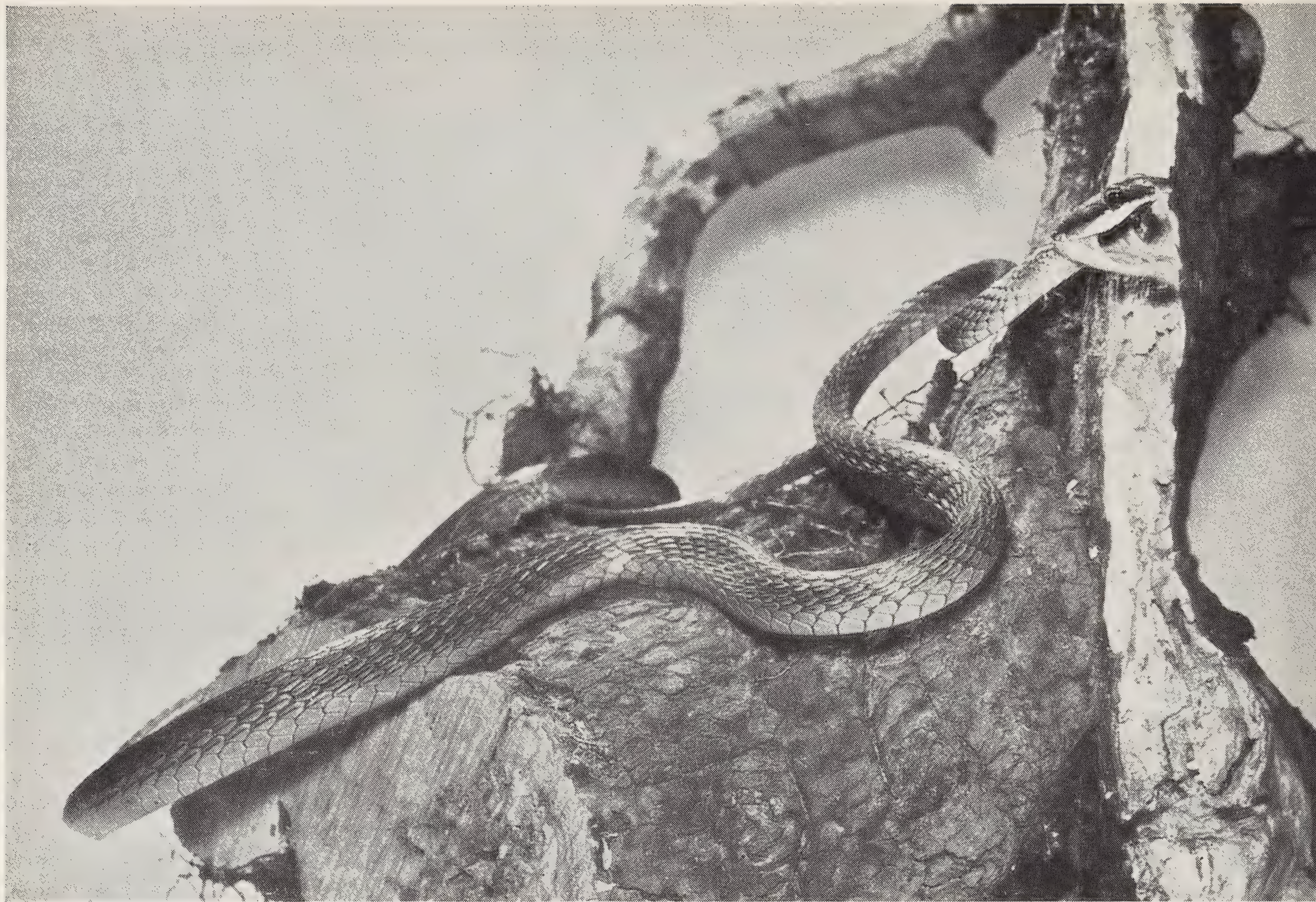


Another case of mixed identity brought an excited call from a young lad in Stamford, Connecticut. A local grocer had found a small, chunky, large-headed, somewhat greenish snake in a stalk of bananas. He had turned it over to this budding herpetologist who believed the snake was a young Bushmaster, one of the most ill-reputed snakes of the American tropics. Boxing his supposedly deadly prize, the boy took his specimen to the local museum for confirmation of the identification. The curator at the Museum was not familiar with this type of snake, but believed that it was a venomous Pit Viper because of the small pit on the side of the face between the eye and the nostril. He suggested that the snake be sent to us. This resulted in the excited call from the young lad. We advised him that we would be interested in seeing his specimen. In due time he brought it to the Reptile House and it proved to be a young individual of the Eyelash or Horned Palm Viper (*Bothrops schlegeli*).

This is an interesting arboreal Pit Viper with a prehensile tail and two or three erect pointed scales over each eye. Adults are greenish-gray or greenish-brown in life, with varying amounts of yellow and light markings, and may attain a length of thirty inches. Our youngster is about a foot in length and is greenish with brick-red bars or irregular spots along the side. In the wild it eats small mammals, small birds and lizards. This is the only venomous snake that we have received in bananas during the four-year period under consideration and is the only one that came through a retail outlet.

The rarest of our banana acquisitions have been two small tree-dwelling boas and two delicate, arboreal snail-eating snakes. The boas are Annulated Boas (*Corallus annulatus*), a species that occurs in the wet forested area of lower Central America and northwestern South America. This form is an attractive chocolate brown with a series of deep red oval-shaped markings along each side,

The third most-frequently-received reptile in banana shipments—and the only lizard that has come to us—is the Spiny-tailed Iguana. Three have come from lower Central America and two were quite small, about a foot long. This particular specimen is nearly 2 feet long.



Only once in the past four years has this interesting Green Tree Snake turned up in shipments of bananas. A harmless species, it eats tree frogs, lizards, birds, small mammals.

occasionally meeting on the back to form red bands. The species is so rare that only two small individuals are preserved in the vast collections of the American Museum of Natural History — both received in banana shipments. The first individual that came to us was nearly dead when received and died the next day, much to our dismay. It was the larger of the two, measuring close to three feet in length, and incidentally it became the third specimen in the Museum's collection. We were sorely disappointed at this loss because it is always a challenge to try to keep such rarities alive. Luckily, a second but smaller boa of the same species came in only a week later. This fellow appears to be adapting itself to the conditions in our Reptile House and has fed twice so far. We hope it will continue to eat heartily and have a long life with us.

The snail-eating snake is equally rare, being

known from only a few preserved specimens in museum collections. Our form is known scientifically as *Dipsas variegata nicholsi* and lives in Panama and northwestern Colombia. These are slender and delicate inhabitants of wet forested areas and seldom live long in captivity. Part of the difficulty of keeping such rarities is their diet of live snails. Fortunately for us the nearby Italian markets are well stocked with several species of live European snails. Our specimens happily have accepted these as a substitute for the succulent tree snails of its native forests.

These snakes eat only the soft body of the snail, pulling it out of the shell by means of special modifications in the lower jaw. It is quite a trick to extract a snail from its shell without using any hands! Only in recent years have these modifications been described and the method of feeding reported. It requires a good deal of effort and time for our snakes to extract the European snails, which are probably larger than the species eaten in the wild. Some of our keepers tried to get the snakes to feed more readily by killing the snails and removing them from the shell. Now

the snakes show a decided preference for snails out of the shell and have developed a marked disdain for those still in the shell, showing a highly satisfactory response to captivity. As of this writing one of our snail-eaters has been with us two years and one month — a good record for these delicate forms.

This account clearly shows that some of our most interesting exhibition specimens have come to us as our special banana bonanza. We sincerely hope that the banana industry will continue to

thrive, to profit and to improve the ways of getting better and better fruit to the northern markets. *But* we also hope that improvements in methods of handling bananas will not entirely eliminate all of the animals that ride northward with the fruit. We welcome the 'phone calls that tell us of another specimen turning up, whether from an excited lad in Connecticut or from a friend at the banana terminal eager to supply us with something new. We are never sure just what will turn up next.

Venomous snakes are quite rare in banana imports, this specimen of the Eyelash Viper (also called the Horned Palm Viper) being the only one we have received in the past four years.



Probably the most interesting of our banana acquisitions is the Snail-eating Snake—whose dietary habits are described by its name. Ours is feeding well, accepting live European snails.



How Birds Handle Their Population Problem

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

THE RECENT great acceleration in the growth of the world's human population is causing thoughtful people much concern. Whether the fullest development of the planet's agricultural resources will finally permit it to support three billion people or six is possibly a debatable question, but there can be no doubt that the present rate of increase cannot be long continued, as nations count time, without bringing very disagreeable consequences to mankind and to the living world as a whole. On the one hand, overpopulation, with the inadequate diet, housing and educational facilities which invariably accompany it, causes the physical, intellectual and moral deterioration of men. On the other hand, the steadily mounting human population presses ever more heavily against the wilderness with all its varied life, so that the greater the number of men who inhabit the world, the less of beauty and interest it has to offer them. Thus those who love both their fellow men and the natural world have a twofold reason for wishing to see the planet's population kept within due bounds.

This population problem is not so new as we sometimes suppose. The ancient Greeks were a



fecund race, and after filling their mountainous peninsula, the Aegean islands and the opposite shores of Asia Minor, sent their colonies far and wide about the shores of the Mediterranean. The two leading Greek philosophers, Plato and Aristotle, gave serious attention to the regulation of the number of men in their ideal states. And long before their time, the wanderings of Neolithic peoples, revealed to archaeologists by the changing distribution of their artifacts, suggest that savage and barbarian tribes frequently outgrew their means of subsistence.

It is far easier to recognize the dangers of overpopulation than to prevent it. Perhaps some light might be thrown upon this difficult problem by considering how it has been met by other species of animals, which like men are capable of producing far more progeny than the land can support. If their solutions have not been reached by intelligent planning, but rather through their millennial interaction with their environment,

they are not for this reason less likely to be illuminating to us. And since the goal of all attempts to regulate human population is to maintain it at a steady level, avoiding the plagues, famines and wars that may suddenly and drastically reduce it, we shall turn for enlightenment to those animals which seem to hold their numbers fairly constant over long periods, rather than to lemmings and other northern vertebrates which pass through cycles in which years of tremendous abundance alternate with years of scarcity.

Those who have studied birds in the wetter areas of the tropics, where heavy forests are the natural vegetation, have been impressed by the constancy of the population of the more common birds, which seem to be present in about the same numbers year after year. One reason for this is the absence of great and widespread catastrophes, such as the blizzards which in northern lands take so heavy a toll of those hardy birds which brave the winters, and the adverse winds which often destroy countless thousands of the migratory kinds. Unlike the birds of high

in whatever zone they breed; but in most groups of birds the tropical members lay smaller sets than the extra-tropical members. Here in southern Costa Rica, most of the nests I find contain only two eggs; sets of three are not uncommon; but those of four are rare, and still larger sets exceedingly rare. In the northern United States, on the contrary, sets of two are rare except in pigeons, hummingbirds and goatsuckers, whereas sets of three to five are perhaps the most frequent among small land birds and far larger sets are found in ducks, pheasants and other families in which the young pick up their own food soon after hatching.

This increase in the size of sets with latitude holds good within families, genera and even wide-ranging species. In Costa Rica the Marbled Wood Quail lays four or rarely five eggs, but in the United States the Bob-white Quail lays from 12 to 18 in a nest. In this locality the Southern House Wren lays three, four or very rarely five eggs, but the North American House Wren has sets of six to eight. With us, Gray's

Russet-capped Nightingale-thrush (left) and nest (right). Thrushes of tropical America about half as many eggs as northern thrushes.

All photographs by the author.

latitudes, most of those of the humid tropics reside the year around in the districts where they breed. Here destructive cataclysms, like volcanic eruptions and hurricanes, are rare and local, not affecting great areas like a devastating winter. Unfortunately, it is difficult to make an accurate census of the birds anywhere, and especially in the heavy vegetation of the tropics; so that our belief that the avian population is fairly constant from year to year is based upon general impressions, or the number of nests in a small area, rather than upon careful counts of whole populations.

The absence in the humid tropics of recurrent spells of severe weather which decimate the bird population is balanced by a low rate of reproduction which cannot increase it rapidly. Ornithologists who visit the tropics from the north are impressed by the small sets of eggs they find. A few avian families, such as pigeons and hummingbirds, lay the same limited number of eggs



Thrush lays two or three eggs, while the American Robin incubates three to five at a time. Innumerable instances of the same sort might be given. There is, however, no abrupt decline in the size of the set as one passes the Tropic of Cancer or of Capricorn; the "latitude effect" holds good within the tropics and beyond them; so that there is in general a slow but steady increase in the size of sets as one passes from the equatorial to the Arctic regions. The wide-ranging Tropical Kingbird (represented in the United States by the race known as Couch's Kingbird) lays sets of four in the South Temperate Zone in Argentina, sets of two or less often three in southern Central America, sets of two to four in



northern Central America, and from three to five in northern Mexico and southern Texas. In the Old World, this increase in set size with latitude has been demonstrated for a number of species in tropical Africa by Mr. R. E. Moreau and in Europe by Dr. David Lack.

One at once asks whether the smaller size of individual broods at lower latitudes might not be compensated by a greater number of nesting attempts in the course of a year which, at least so far as temperature is concerned, seems constantly favorable for breeding. Here in Central America a few hummingbirds, antbirds, pigeons and others are known to nest, *as species*, through most or all of the year; but there is no evidence that any

individual has so long a breeding season. Many of the birds in this region raise two or at most three broods, laying two eggs each time, so that they could not possibly equal the output of a finch of the far north, such as the Snow Bunting, which may follow a successful first brood of six young by a second brood of three. But the most prolific of the birds that nest about my house, the Southern House Wren, with its three or four broods of three or four young each, about equals the annual productivity of its northern relative, with two broods of five to seven.

And now for the question most interesting to us from the point of view of the control of population: why do the tropical birds so often lay smaller sets than the most nearly related forms at higher latitudes? Is it, as Dr. Lack has contended, because they cannot adequately nourish larger families? Since birds generally breed when the sun is on their side of the Equator and days

The Ruddy Rail lays 3 or 4 eggs in Honduras, while the northern rails lay much larger sets of 6 to 12 and sometimes even more.

A typical brood of Amazon Kingfishers—four youngsters. Better Kingfishers in the north have families of five to eight.

are longer than nights, diurnal species nesting at higher latitudes have a longer period of daylight for gathering food for their families than those of regions near the Equator where day and night are approximately equal at all seasons, and this increase in day-length is progressive until in Arctic regions in June the nesting birds enjoy continuous daylight, although they find it necessary to take a few hours of rest in each twenty-four-hour period.

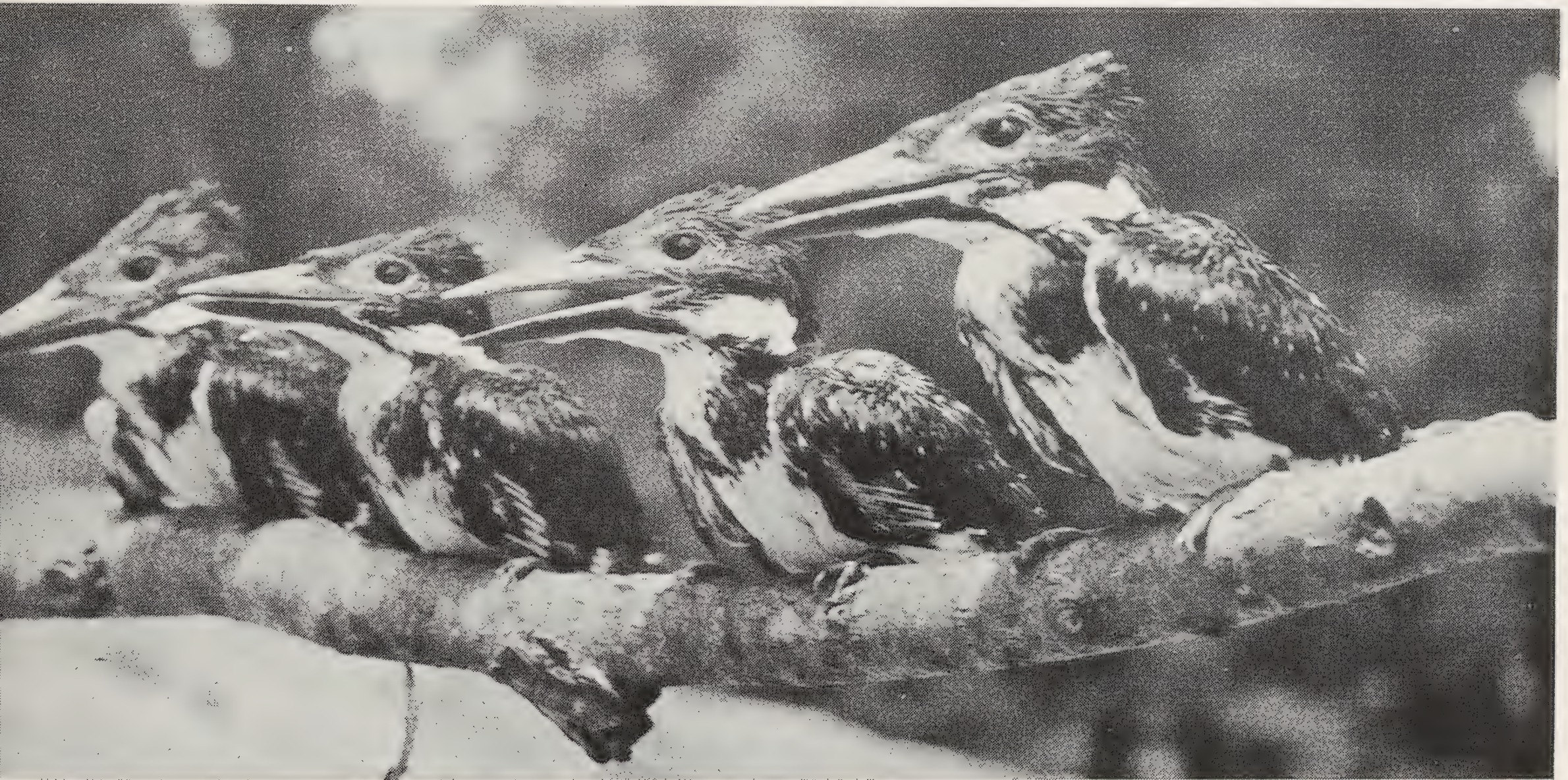
There is one obvious reason for believing that birds everywhere — and other animals, too — must raise as many offspring as the parents can adequately feed without impairing their own health and strength. In many species we find occasional broods larger than normal, and it seems likely that the capacity to lay these larger sets of eggs is heritable. That race or strain within the species that produced the greatest number of

healthy offspring would multiply more rapidly, and so in the course of generations become the prevailing type. This would seem true even if the more rapid reproduction led to great overpopulation and hence to an extremely heavy annual mortality, which would occur chiefly during the season when food is scarcest and conditions on the whole least favorable. For we have supposed that individuals from larger broods are in no way inferior in strength and vigor to those from smaller broods, so that the two groups should lose the same proportion of their total number.

Dr. Lack's careful studies of Swifts, Starlings and other European birds indicate that broods are

severe. In either case, they confront great hazards which birds of the humid tropics do not know, and from time to time are decimated by adverse weather. After each of these periodic catastrophes they begin the breeding season with greatly reduced numbers, and so resemble a pioneer or freely expanding population, in which large families enjoy an advantage they do not have in more densely populated communities. These occasional depressions in population density give the more prolific strains within each species an opportunity for increasing their number which they would lack if the population remained steadily near its optimum.

We must be careful how we extend to the



normally as large as can be adequately nourished; and when more than the usual number of eggs is laid, if some of the resulting young do not succumb in the nest they are likely to leave it underweight and so begin their active life at a disadvantage. Thus the largest broods do not necessarily produce the greatest number of mature offspring, and over the centuries the fecundity of the females has been so adjusted that in a given region they lay sets of a size which in average conditions will yield the maximum number of healthy progeny. But the birds of central and northern Europe, where these studies were made, must either perform a long migratory journey or else face a winter which is often

tropics the results of studies made in the very different conditions of northern lands. There are several reasons for believing that in the humid tropics birds do not on the whole rear families as large as they can adequately nourish. The nests that I most frequently find in the underwood of the rain-forest on my farm belong to hummingbirds, manakins, antbirds, finches and tanagers. In hummingbirds and manakins, the male does not share the labors of the nest and to the female alone falls the task of raising the nestlings. In the antbirds, tanagers and finches, the male takes his due part in feeding the young, and the male antbird even helps to incubate the eggs and brood the nestlings. Yet in both of these



The Violet-eared Hummingbird feeds her nestlings in a cypress tree in Guatemala. The few hummingbirds that nest at high latitudes preserve the family tradition of broods of two.

classes, the number of eggs is regularly two. If the solitary manakins and hummingbirds can rear two nestlings, it would seem that with an equal effort the antbirds, tanagers and finches, with both parents cooperating, could raise four instead of the two which I nearly always find in their nests. It might be argued that differences in food account for the smaller number of young for each attendant in the antbirds, tanagers and finches, but I doubt that this is the true explanation. Among the smaller American or "Tyrant" Flycatchers, there are species in which both sexes feed the young and species in which the female alone attends them, yet there is no constant difference in size of broods in the two groups. Taking the tropical American birds as a whole, there are many altricial or nidicolous species of the most diverse feeding habits in which the female alone attends the nest, and most of these lay two or three eggs, like the majority of the females whose mates regularly help to feed the young. This is to me a most convincing reason for believing that when the two parents join in feeding the young, they are not working as hard, or rearing as many offspring, as they might easily do.

Other observations, less convincing in themselves, support the conclusion drawn from the

lack of correlation between the size of the brood and the number of attendants. Rarely a species which normally lays two eggs will produce a set of three; and in four of the five such cases which I studied, the larger family was successfully fledged. Many of the small birds of the tropical forest bring their nestlings big portions of food at rather long intervals; and the advantage of this seems to be that the fewer the visits to the nest, the less likely are the parents to betray its position to predators which rely chiefly upon sight, such as snakes and hawks. Yet if these parents with slow rates of feeding are kept away from their nests until their young are unusually hungry, they can greatly accelerate their rate of food-bringing, as I have seen on several occasions with antbirds. This suggests that food is not hard to find in the rain-forest, and in nourishing their usual brood of two the birds are by no means working to the limit of their strength.

We can hardly escape the conclusion that small birds of the humid tropics do not raise broods as large as they could adequately attend; nor do they seem to attempt as many broods in the course of the year as their own strength and external conditions would permit. Their rate of reproduction seems to be adjusted to their annual losses rather than pushed to the limit of their capacity, as appears to be true of a number of northern birds. Another wholly distinct set of facts reveals that birds as a class do not reproduce as rapidly as they might. Anyone who has

kept domestic quadrupeds, such as horses and cows, knows that they can breed before they have stopped growing, and the same is true of man. But wild birds seem practically always to reach full adult size before they begin to reproduce. Many of the larger birds, as penguins, herons and petrels, delay to breed until several years after they have attained adult stature. The Royal Albatross does not start nesting until nine or ten years of age, and the Fulmar of the North Atlantic not before it is seven years old, or even eight or nine. Like other petrels, the Fulmars incubate one egg at a time, yet in recent decades they have been spreading in a spectacular fashion about the shores of the British Isles, indicating that their slow rate of reproduction is quite adequate for maintaining their numbers and even for rapid expansion.

Is it not remarkable that these birds and numerous others should require a longer period to reach reproductive maturity than many mammals whose size is so much greater than theirs? It appears that after they have completed their growth in stature some inhibiting factor comes into play and delays for one or more years the development of their organs of reproduction; and in view of the fact that these birds are quite capable of maintaining their numbers, it seems that this is an adaptation to prevent superfluous breeding

and overcrowding, with resulting strife between individuals and starvation. It is far more difficult to understand how such an adaptation could evolve than in the case of many modifications which give a more immediate and obvious advantage to the birds which possess them, such as stronger flight or better concealment of the nest. But the subtle interactions between living things, continued for countless generations, produce results which are far from obvious and confound our too facile theories.

To conclude, birds avoid excessive increase in numbers in two distinct ways. Many of the longer-lived species delay breeding for one or more years after they have attained adult stature. Many tropical species lay only two or three eggs in a set although they seem capable of giving adequate care to larger families; and they do not compensate for these small broods by raising a larger number of them each year. These adjustments are not, like late marriage and small families among ourselves, socially determined practices, but are controlled by genetic modifications that have arisen in the course of a long evolution. We know little of the manner in which these adjustments were brought about; but in view of their relevance to one of the most pressing problems of mankind, they seem worthy of our careful study.

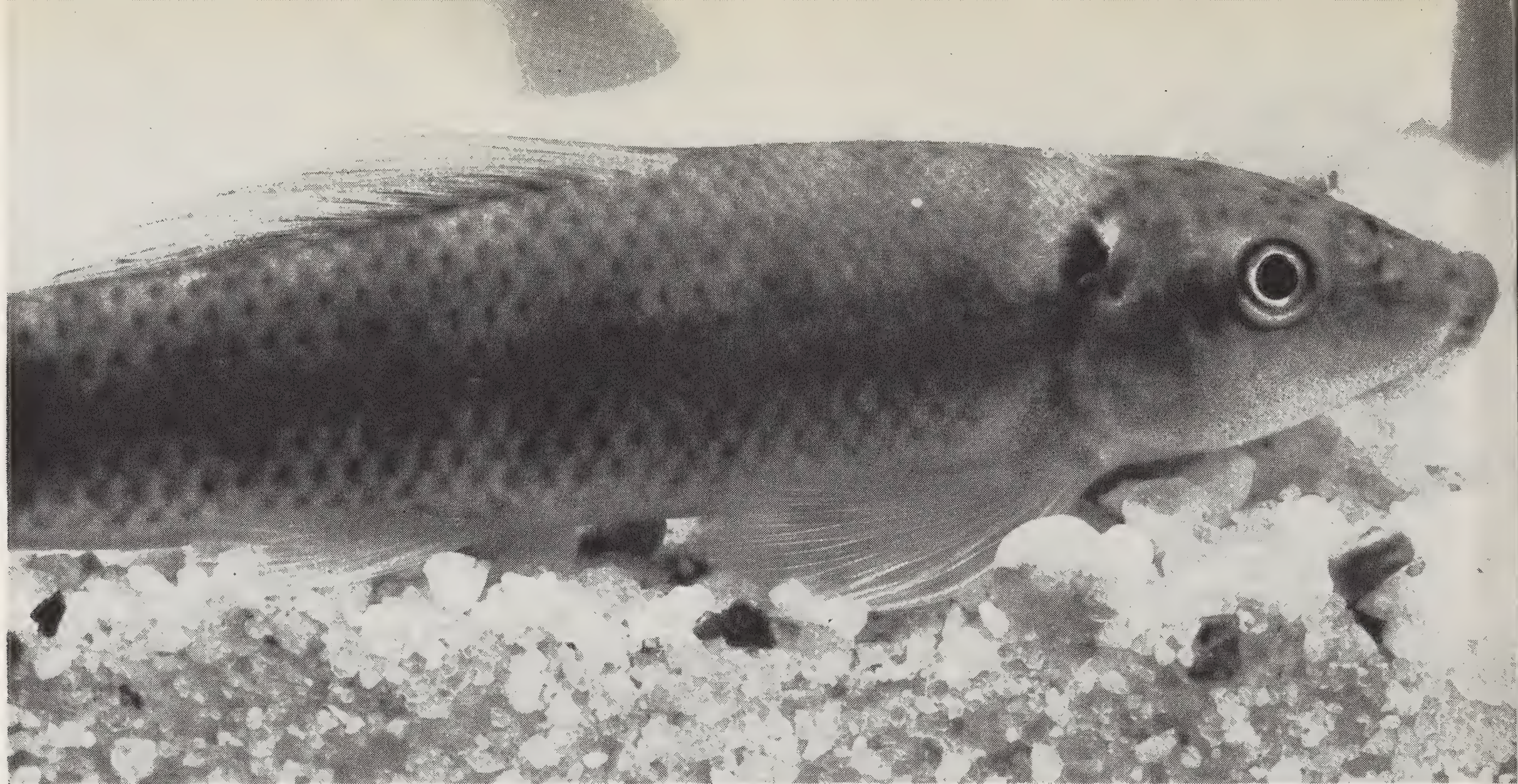
The Fish with Holes in Its Head

By JAMES W. ATZ

IF, in a game of charades, you were called upon to act out the word "fish," the chances are that you could make yourself most recognizably fish-like by looking wide-eyed while you puckered your lips and with them made motions as if blowing bubbles. Even persons whose acquaintance with living fish consists solely of a glance or two into a goldfish bowl would identify the unblinking eye and constantly opening and

closing mouth as characteristic of the fish. In fact, so many people have noted how fish continuously take in water through their mouths that when we want to describe a heavy imbibor of our own species we say that he drinks like a fish.

Of course, most of us know the fish is not drinking all that water. Rather it is breathing it. Just as we must regularly take air into our lungs, so must the fish keep a continuous supply of



water passing over its gills. But the differences between the breathing of man and fish embrace more than the dissimilarity between lungs and gills or air and water. In man the air enters the lungs by way of either nose or mouth and it leaves by the same two confluent ways, while in fish the water can enter only through the mouth, and it leaves the gills by an entirely different route, passing out under the gill-covers on either side of the rear of the head.

There are, however, so many different kinds of fishes — some 25,000 or more species — and so varied are they in structure and way of life, that the ichthyologist is not surprised when he finds exceptions to almost every generalization that has ever been made about them. For example, there are a number of fishes that breathe air, like terrestrial animals, instead of water. Many of these drown if kept under water and not allowed to come to the surface to gulp air. Then there is a handful of fishes in which the nose communicates with the mouth. (The typical fish nose consists of a U-shaped tube, both ends of which communicate with the outside of the body). In these the nose may be used for breathing as well as smelling, the latter being its sole function in the vast majority of fishes.

The Aquarium recently acquired another outstanding example of a fish with peculiar methods of breathing. Although it possesses gills like any ordinary fish and breathes water, too, it can do this without taking any water at all into its mouth.

So far as we know, this fish has never been

kept in captivity before outside of its native Thailand, and has never been assigned a popular name — except for some local Siamese ones given to it. Its scientific name is *Gyrinocheilus aymonieri*. In order to provide the fish with a more descriptive, if no more euphonious appellation, we propose to call it the Siamese Head-breather. As pointed out before, most fishes are mouth-breathers; the fact that *Gyrinocheilus* is not is its greatest claim to ichthyological fame.

Looking at the Siamese Head-breather for the first time, one is not impressed by any outstanding peculiarity in form or behavior. Certainly it would not appear to warrant the distinction of being in any respect “the most remarkable of Oriental fresh-water fishes,” as Dr. Hugh M. Smith, the great authority on Siamese fishes, once called it.¹ The fish looks and acts as if it were one of the many suckers that frequent the bottoms of streams and lakes of North America. Only an expert would be aware of the differences in conformation as well as fin and mouth structure that show that despite its rather sucker-like mouth and shape, it is not a sucker at all.

Its outstanding structural peculiarity might pass unnoticed, even though it is apparent once it has been pointed out. Behind each eye, just above the gill-cover, is a good-sized opening which seems to lead straight into the head. In our three-and-one-half inch specimen, each of these openings was slightly more than an eighth of an inch in its greatest dimension.

¹ Smith, *Bull. U. S. Nat'l Mus.*, (188): 281-286, 1945.

Just inside is a membranous flap of skin that undoubtedly acts as a valve, for it may be seen rapidly moving back and forth when the fish is breathing. At the same time, a thin flap running along the edge of the gill-cover, which lies directly below the opening, also vibrates so that it rapidly opens and closes the narrow slit separating the gill-cover from the body. Water for respiration enters the two openings and passes forward to the anterior limit of the gill chamber. Then it flows down and back over the gills, being drawn out through the opercular slit by means of the vibrating flap along the gill-cover's edge. Not much water can be drawn in through the two openings, but the extreme rapidity with

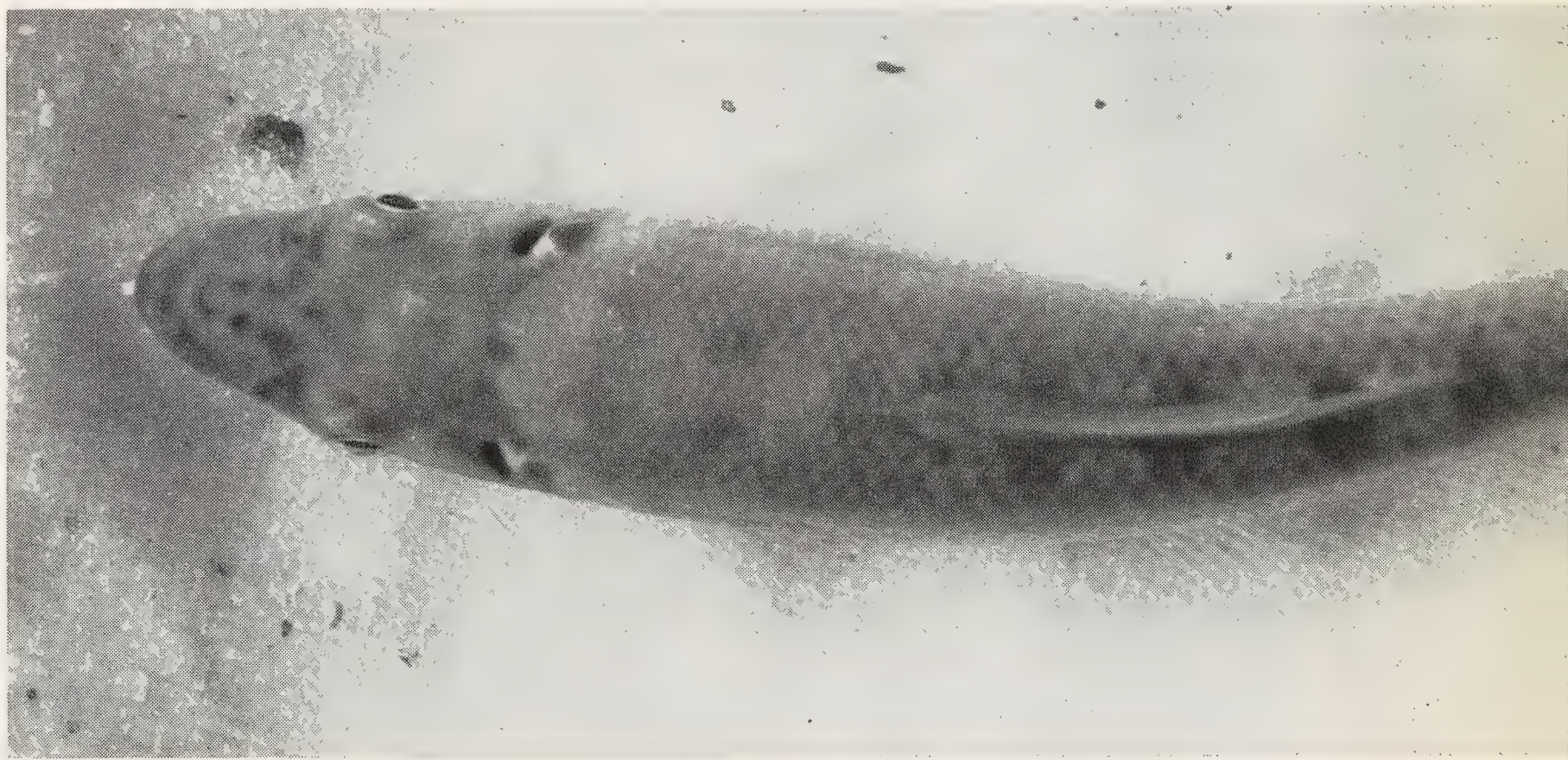
stones. Here, too, the fish can occupy its sucking, scraping mouth entirely with food-getting while respiration takes care of itself. Like many other vegetarian fishes, the Head-breather's intestine is long and coiled to allow ample space and time for the slow digestion of tough plant materials.

All this makes the Siamese Head-breather and its close relative, the Bornean Head-breather, *Gyrinocheilus pustulosus*, unique. No other fish exhibits such inhalent openings to the gills. Because of them and certain other more-or-less associated structures, ichthyologists have put these two species into a Family of their own.²

Our specimen of Head-breather came from one of the tanks of Mr. Sol Soberman, a Bronx fish

The hole in the fish's head is just in front of the dark pigment spot behind the eye. Here it appears closed by the valve.

This Siamese Head-breather is 3½ inches long, but it is recorded in the wild state up to a length of about 8 inches.



which the opercular flaps move seems to compensate for this. As many as 240 back-and-forth movements per minute have been counted.¹ Apparently the Head-breather cannot breathe in an ordinary manner, that is, through its mouth, even though that organ is still connected with the gill chamber on either side of the head.

The utility of this arrangement is obvious, once the Head-breather's habitat and feeding methods are considered. The fish lives primarily in mountainous streams, and even when in an aquarium of standing water can be seen clinging to the bottom or sides by means of its sucking mouth, all the while breathing water through the two extra holes in its head. The ability to fasten itself to a rock for extended periods must keep the Head-breather from being washed downstream by the torrential flow of water in its native streams. Moreover, it feeds exclusively, or almost so, on algae scraped from the surface of underwater

fancier. Mr. Soberman had recognized his fish as a queer one, but it was Mr. Joseph Armstrong, our new Tankman, who identified it as a real rarity and urged Mr. Soberman to present it to the Aquarium.

One of the most remarkable things about the Siamese Head-breather is its ability to thrive in small standing aquaria. This faculty, which is highly unusual for a fish used to swift flowing waters, finds at least a partial explanation in the fact that the fish is not confined to mountain streams in nature but also occurs in still waters. Nevertheless, the aquarist must consider himself fortunate that this is indeed the case. More Head-breathers will undoubtedly turn up, and when they do, they should easily be maintained both in the laboratory for study and in exhibition tanks for the public to see.

² Ramaswami, *Proc. Nat'l Inst. Sci. India*, 18 (2): 125-140, 1952.

Black Bear Cubs at Last

Photographs by

SAM DUNTON

The Black Bear cubs whose first excursions out of doors under their own power we have been awaiting eagerly since the end of January, finally made their appearance on April 15—two and a half months after their birth on January 31. Although the volume of sounds from inside their den in a rock ledge indicated that there might be three, the number turned out to be two. Cubs are often destroyed by the father; in this instance the male died before the cubs were born.

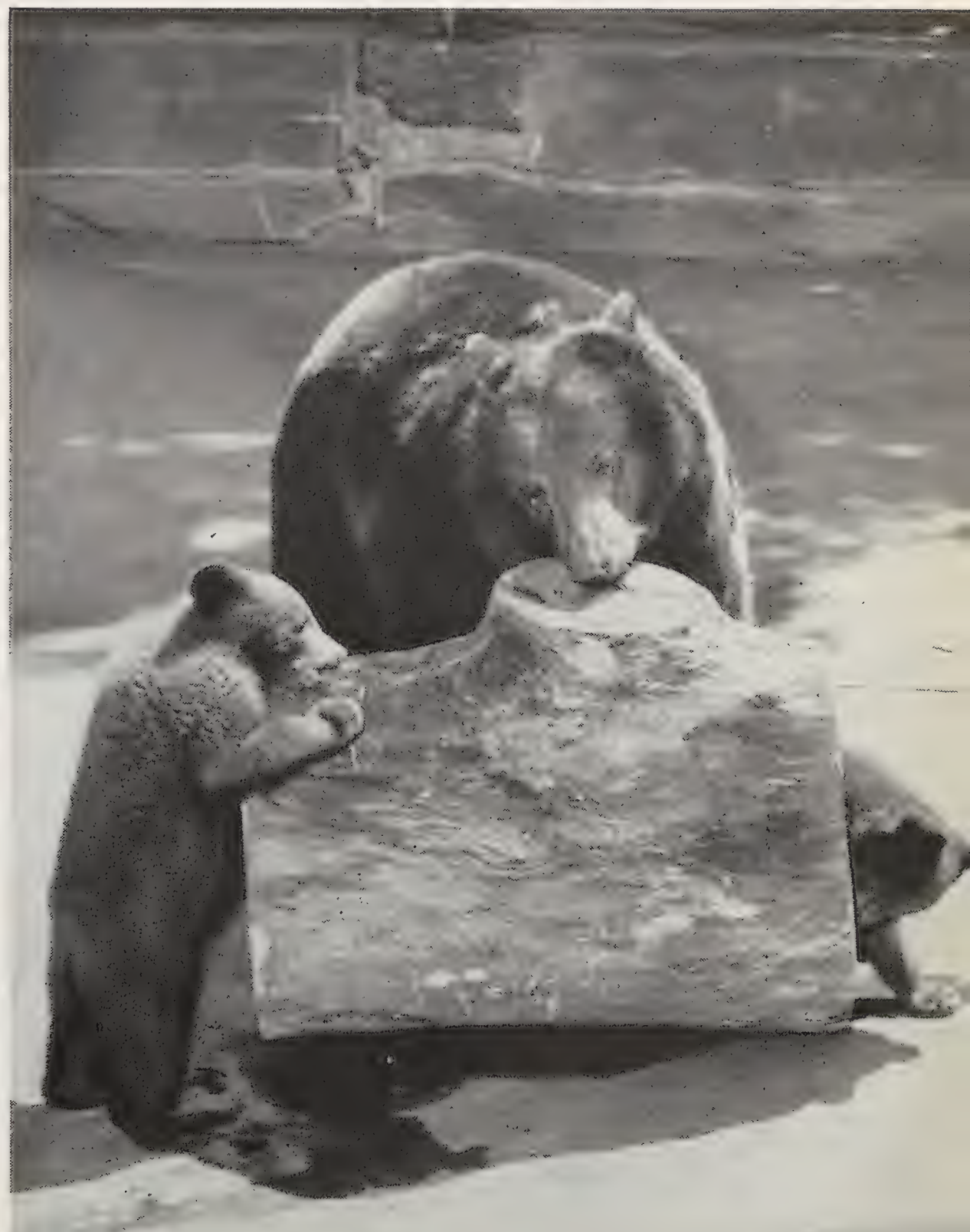




A section of hollow log is the only plaything the cubs seem to be interested in—but it holds an unlimited possibility for fun.



As little teeth grow longer and sharper, we are probably going to need a new log. Already it is well-scarred by their teeth.



NINE-BANDED ARMADILLO—

Invader from the South

By G. DALE BUCHANAN

*Graduate Assistant in Biology, The Rice Institute,
Houston, Texas*

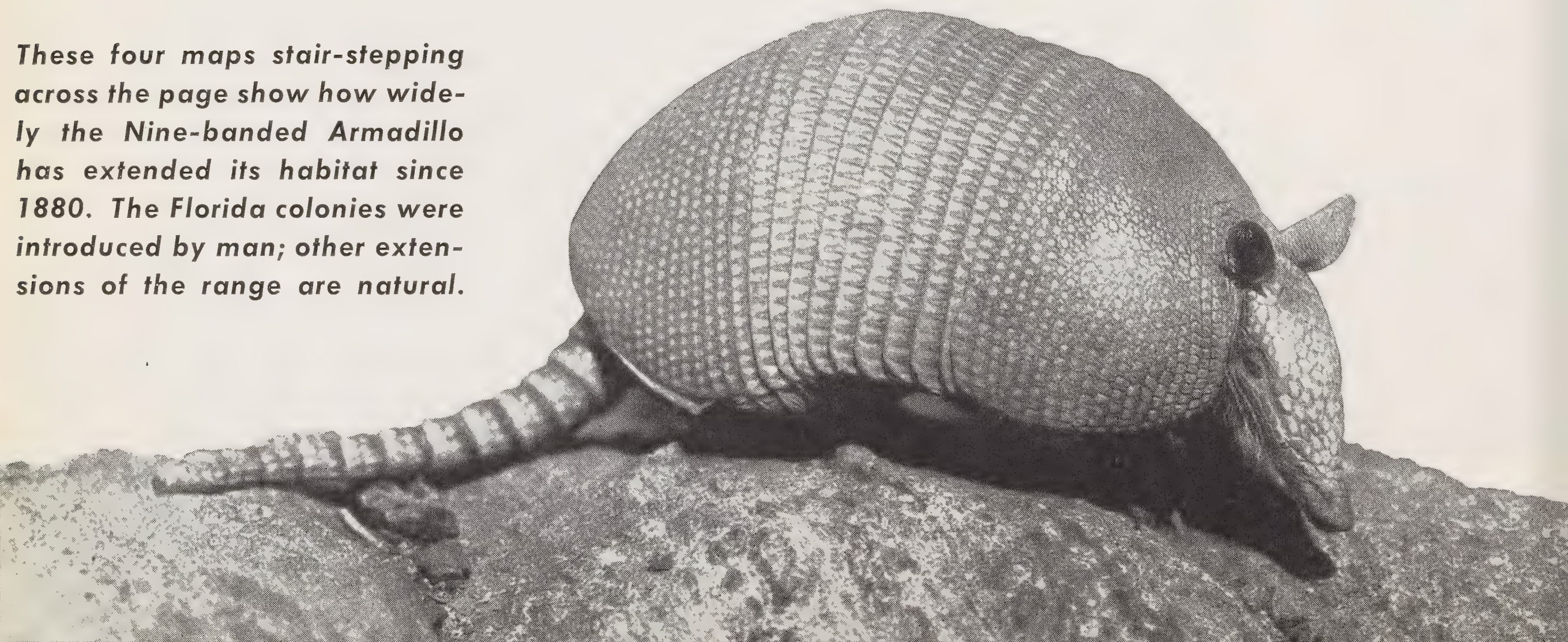
IN 1854 J. J. Audubon published Volume III of his monumental and beautiful *Quadrupeds of North America* and in it is the first reference to the Nine-banded Armadillo in the United States. Audubon reported that the animal occurred in the southern portion of Texas along the lower shores of the Rio Grande river. Exactly one century later the *Texas Journal of Science* published an article, written in part by myself, in which the armadillo is reported from every state along the Gulf coast, as well as Oklahoma and Arkansas, and still spreading. This is

no startling revelation, since it has been known for a long time, and suspected even longer, that *Dasypus novemcinctus*, like the conquistadores



of old, was sweeping northward from the plains of New Grenada. Yet each chronicling of the whereabouts of this not-so-furry friend of ours brings to the mind of the naturalist a host of questions. When did the armadillo begin the expansion of its range? What started it? How far will it go? When and where will it finally halt, and what may halt it?

These four maps stair-stepping across the page show how widely the Nine-banded Armadillo has extended its habitat since 1880. The Florida colonies were introduced by man; other extensions of the range are natural.



To find the answers to these questions — if, indeed, they are answerable — we must know something of the nature of the beast. One's first glimpse of an armadillo, whether it be the first ever or merely the first of the hour, is always disconcerting, for it seems as if it might, equally well, be either a reptilian mammal or a mammalian reptile. Even when reciting its taxonomic



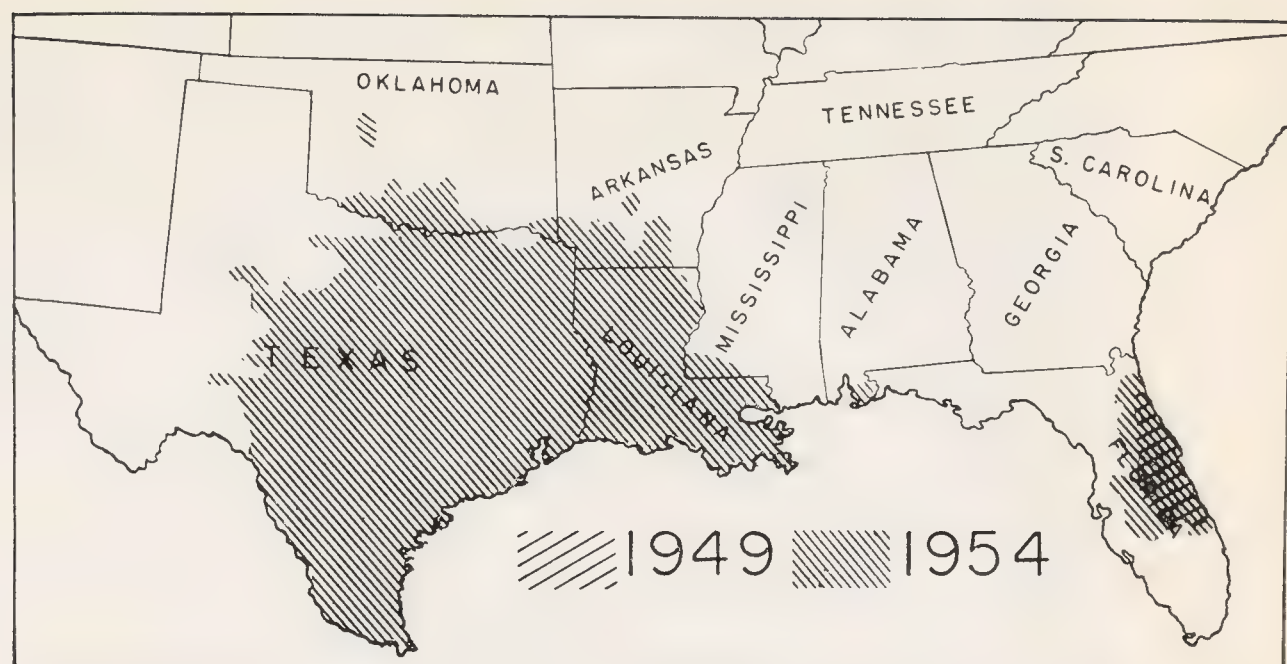
pedigree there is an urge to look behind to see if perchance, like Alice, one has stepped through the looking glass.

As a matter of fact, the armadillo looks not at all unlike the Mock Turtle and is almost as unlikely.

Except for the ears, which are decidedly mulish, the armadillo's head resembles a pig's. The shell obscures all contours of the body and the animal is perpetually peeking at the world as from beneath a bowl. When the shell is removed, the carcass is about the size and shape of a rabbit's, except that it is much sturdier.

Most people tend to look upon the armadillo as a rather primitive animal, because of its generally reptilian appearance and its obvious affinity with the extinct glyptodons. Primitive in the sense that it comes from an ancient stock it may be, but primitive in the sense that it lacks complexity it most certainly is not. The reproductive cycle of the armadillo presents two of the most baffling and interesting aspects of mammalian reproduction. The Nine-banded Armadillo and a related species, the Mulita Armadillo (*Dasypus hybridus*), exhibit specific polyembryony, giving birth to quadruplets and octuplets respectively from a single egg.

In addition, the armadillo has incorporated into its reproductive cycle a phenomenon which, while of little apparent value to it in its South



American habitat, may be of great importance in allowing it to move into more temperate climates. Armadillos mate in the late spring and early summer but because of a period of delayed implantation, of some four months' duration, gestation does not start until early winter. As a result the young are not born until the spring of the year, which probably increases considerably their survival chances.

One's first impression of an armadillo is that it is remarkably stupid. Later observations only tend to confirm this idea. The armadillo has a highly developed sense of smell, being able to locate insects and worms beneath six or more inches of earth. It is asserted that the armadillo employs its nose as its first line of defense also. This idea is supported by the animal's habit of rearing up on its haunches and testing the air. On the other hand, an armadillo is likely to walk right up to a man and sniff about as if it had absolutely no sense of smell whatsoever. Its hearing has been described as poor by many observers, but the evidence is conflicting. On occasion an armadillo may be quite sensitive to noise, moving away at the slightest crackling of a leaf. At other times it may be approached noisily without it acknowledging one's presence. Its eyes are poor at best and it makes little use of them. If one can be induced to flee, it is as likely to charge headlong into a tree as go around. We can only conclude that except for the eyes its senses are not inadequate but that its response to sensations are inconsistent, to say the least.

Although it is generally silent, the armadillo is not mute. The sound most often heard is a sort of wheezy grunt, usually made when digging or feeding. There is also a buzzing noise, made when the animal is thoroughly alarmed. The buzzing sounds much like a wind-up mechanical

toy when it is allowed to run wild at top speed.

The armadillo is considered to be nocturnal or crepuscular. While this is ordinarily accurate, there is reason to believe that it is oriented not so much with respect to light as with temperature. It is true that during the summer the armadillo seldom goes abroad until dark, but if the temperature happens to fall during daylight hours as a result of a shower, it may be seen shortly thereafter. In cold weather, on the other hand, the armadillo comes out in the afternoon, or, if it is very cold, not at all.

Upon leaving its burrow, the armadillo immediately begins to forage. A feeding armadillo is a perfect picture of devotion to duty, for when so occupied it is almost oblivious to its surroundings. It leaves a distinctive and easily-recognized trail wherever it goes, since the tail often drags, making an imprint not unlike that of a rope. It is to be feared that the armadillo receives the blame for many misdeeds perpetrated by other animals which precede it to a given spot, as a result of the noticeable track it leaves.

There are many tall tales about the abilities of armadillos but one of the seemingly wildest is the allegation that it can walk under water. What is more amazing than the story itself is the fact that it is true. There are no confirmed reports of anyone observing an armadillo voluntarily using this method to cross a stream, but several workers have put armadillos into ponds and have seen them walk out a few minutes later. Two factors enable the animal to accomplish this distinctly unmammalian feat. First, the armadillo can survive for six or more minutes without being able to breathe. Second, it has a normal specific gravity of 1.06, so that it can maintain itself on the bottom without too much effort. Armadillos *can* swim and they ordinarily do so when placed in water, although their high specific gravity makes swimming something of a problem. This the armadillo has solved in a most interesting manner. When first placed in water, it sinks, struggles to the surface, gasps and sinks again. Just when it appears that all is lost, it rises, dog-paddles to shore and heads for home. An arma-

LEFT & RIGHT—Night photographs by flashlight of armadillos foraging in a stubble field. In the photograph at the left, the animal is carrying its tail well off the ground—a stance it rarely employs.

Photographs from the author.

dillo which has been swimming is particularly rotund. The reason is that instead of gasping its last while struggling in the water, it was ingesting air so as to make itself lighter than the water.

One of the best ways *not* to hunt armadillos is to dig one out of its hole. In the first place, there are a good many more holes than armadillos. In the second place, most burrows have their entrance at the base of a tree or shrub or in the center of a patch of thorny vegetation, such as wild roses or brambles. Wherever possible, armadillos seem to enjoy digging their holes into the side of a bank (at the base of some tree or bush, of course). This means that the depth of the tunnel below the surface is liable to be considerable.

The number of burrows per armadillo varies with the "diggability" of the soil and may range from two or three to as many as fifteen. The





function of the supplementary burrows is not really known. It has been suggested that they may serve as food traps, but armadillos do not seem to make a point of visiting them regularly. They can and do serve as hiding places, but are likely not dug for such a purpose.

The home burrow is usually more elaborate than the supplementary holes and may have more than one entrance. The nest proper is merely a widened chamber which the animal stuffs with leaves. When retiring the armadillo forces its way into this mass and literally packs itself into bed. This practice doubtless provides good insulation and in part performs the same function as does the fur of most mammals.

The armadillo's method of getting leaves into the nest is unique. The animal makes a pile of leaves, squats down over it and then backs toward the burrow, raking any stray leaves back under the shell with its forepaws. The tail seems to be used as a tactile organ during this operation, but this is not certain. The nesting material is

changed at intervals when it gets wet or moldy.

Feral armadillos are primarily insectivorous and any region which will not support a suitable insect population will not support armadillos. This is admittedly a generalization and my faith in its invariable truth was considerably shaken recently by the discovery in the colon of an armadillo of two fairly large pieces of material which were definitely of mammalian origin. Captive armadillos are quite omnivorous and in our laboratories they are fed a routine diet of raw horsemeat and canned dog food. Should they acquire the knack of eating small rodents (or something similar), as some South American species are reported to do, they might be able to move into areas from which they are now excluded by reason of diet.

The armadillo has long been accused of being a destroyer of the eggs of quail and other birds. Several years ago, a good deal of experimentation showed that at most armadillos accounted for a very small amount of damage to quail eggs. As

a matter of fact, there is only one instance recorded in which quail eggs were found in the stomach of a wild armadillo.

Watching an armadillo in its native environs makes one wonder how it can possibly survive for more than a few days. It is noisy and unconcerned and in fact performs its daily rounds with the same fearless oblivion as the skunk or porcupine. One wonders if it, too, has some powerful weapon comparable to quill or scent which gives it free passage through the woods. Surprisingly, the only defenses which the armadillo has are passive, and once caught it would make a delicious meal. But catching an armadillo is no mean trick. The animal is deceptively fast and in addition has its shell to rely upon.

There is probably more long-standing misinformation about the armadillo's shell than about any other portion of its anatomy. Early authors (and unfortunately some very recent ones) claimed that the armadillo rolled "into an iron-clad ball" when threatened, and some even said it rolled down hill to escape its enemies. In the first place, a Nine-banded Armadillo cannot be rolled into a closed ball. I have tried unsuccessfully to do this with anesthetized animals. Now,

the South American Three-banded Armadillo (*Tolypeutes tricinctus*) can and does roll into a ball. In this species the shell is very sturdy and the edges fit together perfectly. C. C. Sanborn reports that the shell is adequate protection from predators and that dogs will not even pursue the Three-banded Armadillo, although they make great sport of chasing and capturing the Six- and Nine-banded Armadillos in the same area. So far as is known, no other armadillo rolls into a ball when attacked. The real function of the Nine-banded Armadillo's shell is similar to that of the cowboy's chaps. An armadillo can plunge full tilt into underbrush so thick and thorny that nothing except another armadillo could hope to follow it. In addition, the shell offers no mouthhold for any would-be predator. The effectiveness of the armadillo's defenses is borne out by the paucity of reports of the finding of armadillo remains in the stomach contents of such predators as wolves, coyotes, cougars, etc.

Although the shell is one of its main lines of defense, it is at the same time perhaps its biggest limitation. The armadillo has poor temperature control and is in fact unable to maintain a constant body temperature in the face of low air



temperatures. This intolerance of cold results in part from the loss of hair in favor of the dermal scutes which comprise the shell. Actually this is not the whole story, for the armadillo has a normal body temperature considerably below that of most mammals. Although the point has not been checked, it seems probable that it has a lower basal metabolic rate than is normal. Perhaps the low metabolic rate represents an adjustment of energy production to that which can be profitably retained by the body. As previously mentioned, the method of nest construction may play a role compensatory for the lack of fur.

The armadillo does not hibernate, but it is able to remain in the nest several days, and in an area where there are no prolonged spells of freezing weather it seems able to forage sufficiently in the warm periods between freezes.

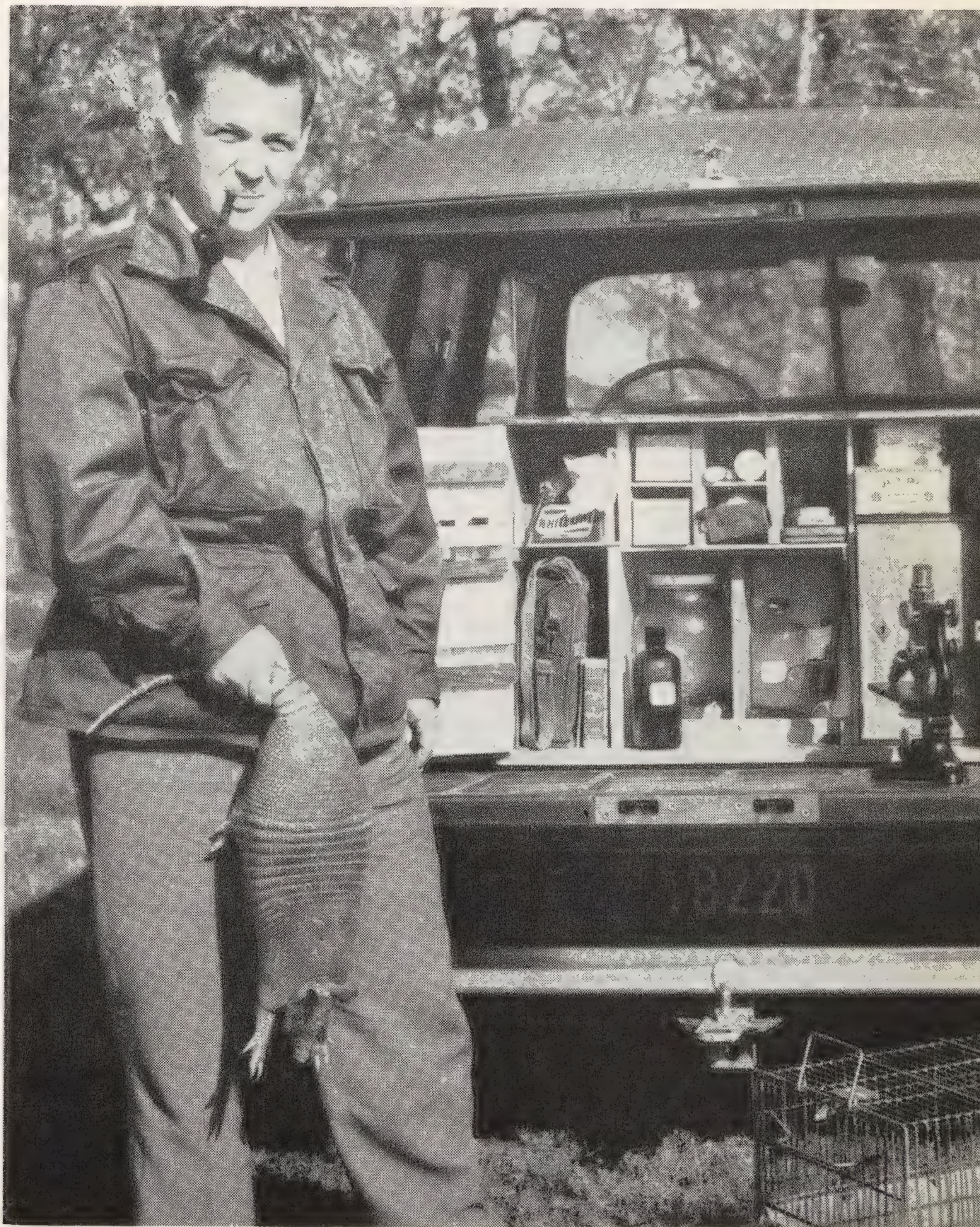
THE SPREAD of the armadillo in the United States is interesting in that it has not been simply the ballooning of the range in an ever increasing arc, but has been quite directional. After crossing the Nueces River around 1880, the armadillo moved north and west and in the early years of this century had reached the central part of the Texas plains region. In addition a finger-like projection of the population went directly up the Pecos Valley in West Texas and entered New Mexico. The armadillo does not presently occur in this area and so far as can be determined, has been absent for more than twenty years. The Pecos region is normally too

LEFT—In dry, tangled country like this, the armadillo is thoroughly at home. RIGHT—The author brings a specimen to a field laboratory. This is the "only effective way to hold an armadillo," he says.

arid to support the insect life on which armadillos feed and it must have been a series of extremely fortuitous events which allowed it to move into this area even temporarily.

Halted to the west, the armadillo turned eastward and moved quickly up the coastal prairies into the forests of East Texas and Louisiana. It had acquired the unearned reputation of being a denizen of semi-desert country, and it was surprising to many to discover that the armadillo took quite readily to the swamps of Louisiana. In

fact this state is the only one which can claim to be completely populated by the Nine-banded Armadillo. In Louisiana the animals again turned north along the Canadian-Arkansas-Red river system and moved by this route into Arkansas and Oklahoma before the vanguard of the main Texas population had reached the Oklahoma-Texas border. The armadillo has been unable to stay in large numbers in upper Oklahoma and Arkansas but is found abundantly in the southern portions of both states.



The Mississippi river appears to have posed somewhat of a barrier to the eastward movement of the armadillo but it has been crossed in southern Louisiana. Exactly how the crossing was effected is not certain. It is possible the armadillo swam across, but this was most likely accidental. Perhaps animals trapped by flood waters were deposited on the far bank somewhere downstream. Certainly some have been carried across by people.

In two instances man has materially aided the

armadillo in conquering new territory. Colonies are well established in parts of Alabama, obviously having been brought in by human agency. The same thing happened in Florida and this case is interesting in that the entire armadillo population in that state apparently arose from a comparative handful of animals brought in on three separate occasions. A pair was liberated near Miami during World War I and increased for a while but has since died out or moved northward. A few animals escaped from a small zoo near Cocoa in 1924 and several were lost from an overturned circus truck in the same area in 1936. The armadillo presently occupies some 15,000 square miles of the state, being found along the eastern coast from just above Miami northward to Jacksonville and almost spanning the state near Tampa.

As the foregoing paragraphs indicate, we have a fair knowledge of the spread of the armadillo in the last century. Before that time, however, we know little or nothing. It is generally assumed that the Nine-banded Armadillo had a stable range prior to the 1850s but the record is meager on this point.

The only indication that the armadillo had a stable range a hundred years ago is the fact that early journals and accounts of life in Texas refer to it as a Mexican animal which sometimes found its way north of the Rio Grande. Several workers have expressed the belief that the decimation of the larger carnivores, which occurred as the country was being settled, allowed the armadillo to move into new territory. Certainly the armadillo *was* moving north at this time, but there is no proof that it had not been moving upward from South America for several centuries and that this movement was noted only when civilization had pushed far enough south to meet it. It has already been mentioned that there is little proof that predation ever was a problem to the armadillo.

A few years ago W. Armstrong Price and Gordon Gunter, the former a geologist, the latter a biologist, combined their talents in an article concerning possible causative factors in the range expansion of the armadillo and several other animals and plants. Prior to the 1870s the so-called chaparral brush of which mesquite is the dominant species was confined to the southern part

of Texas, generally south of the Nueces river. In that decade and following, the chaparral began to encroach upon the coastal prairies to the north and east. It is postulated that overgrazing, coupled with several droughts in the 1880s, allowed the chaparral to supplant the grasses. Concomitant with these changes, several animals including the Coati-mundi and the armadillo moved into the same area. The armadillo has long since outstripped the chaparral, which stopped at the edge of the humid zone, but the possibility that this fundamental ecological change triggered the northward push of these animals is most intriguing.

It is my feeling that there is too little evidence to support the contention that the armadillo had a stable range in the past, and I rather tend to the idea that the armadillo has been advancing for some considerable time. If, however, this is not the case, I think that research of the type reported by Price and Gunter approaches most closely the real answer to the problem.

There is little doubt that its limited ability to withstand cold will finally determine the northern limit of the armadillo's range. At least twice in the past the northern limit has been described. The latest was offered in 1913 by H. H. Newman, who suggested that the armadillo would not be able to stay permanently north of the 33rd parallel. Since the 35th parallel cuts across Oklahoma and Arkansas at about the upper limits of the armadillo's present range, and there are already several reports of the animal being found in Kansas and Missouri, it appears as yet unsafe to select still another line beyond which it will not pass.

The armadillo presently occupies a quarter of a million square miles of the United States. It has surely reached its westernmost point and now may be doing the same thing in the north. This is not the situation to the east, however, and unless conditions are drastically altered we can expect in our lifetimes to see the link-up between the populations in Alabama and Florida with the main group which is now beginning to surge into Mississippi. Perhaps in the year 2054 some naturalist, in describing the distribution of the Nine-banded Armadillo in Tennessee and the Carolinas, will preface his report: "In 1854 J. J. Audubon . . ."

The 54th Expedition of Our Department of Tropical Research—

A SUMMER IN ASIA

By WILLIAM BEEBE

USUALLY, after a season at Simla in the northern range of Trinidad, the staff members of the Department of Tropical Research foregather for a summer in the laboratory in the Zoological Park. The field work is correlated with references in the literature; specimens are identified or sent away to specialists, and papers take shape for final publication.

This time, owing to a happy concatenation of events, this sequence will be reversed; half-digested notes laid aside for a time and entirely new activities undertaken.

The itinerary and personnel of the newly-planned expedition are as follows: Beebe, Crane and Kenedy sailed on the *Andrea Doria* from New York on May 19 for Naples. The party is joined by our friends Redfield Vose, Polly Evans and Laura Schlageter, and will sail on June 8 on the *Asia* for Singapore. From then on, the length of stay and possible trips to Darjeeling, Borneo and Colombo will be governed by individual researches, and by travelling conditions.

For Jocelyn Crane the trip will be the vital first phase of a world-wide, five-year study of fiddler crabs and their relations, collectively known as ocypodids. To a comparative behaviorist, this First Family of Crabs is one of the most exciting groups in the animal kingdom. Their accomplishments range from complex color changes to a knack of sifting food from the mud of a tropical swamp. Their courtship displays are so distinctive you can recognize the species by the patterns of their claw-waving, side-stepping dances. Some spend their adult lives in a three-inch circle, and one can keep pace with a cantering horse. Lots of them fight their rivals and a few even make noises.

The entire ocypodid undertaking is being made possible by a grant from the National Science Foundation. The work this summer will be centered around Singapore, where legions of the crabs thrive on the beaches and in the muddy mangrove swamps of Malaya. There Miss Crane expects to observe, photograph and collect some twelve genera and fifty species. En route, too, are made-to-order opportunities for work — stops in Suez, Aden, Karachi, Bombay and Colombo. To others these names hold all the glamor of the East, but to a devotee of ocypodids they are, first-of-all, the homes of unknown fiddlers, beckoning on a far-off muddy shore.

As for myself, I have two main objects in making this trip. Exactly forty-five years ago I travelled through most of the Far East: India, Ceylon, the Malay States, Java, Borneo, the Himalayas, China, Mongolia and Japan, and as a result produced a four-volume Monograph of the Pheasants. Today I will gather whatever information is available as to changes which have taken place in the populations of wild pheasants throughout the intervening almost half-century.

A second concern will be a comparison between the faunas of Singapore Island and Trinidad. The two islands offer several reasonable comparisons, such as their geographical location closely adjoining continental mainlands, as well as being on opposite sides of the earth. Their size is not too dissimilar, both are humid and tropical, and both were colonized by the British, resulting in an unusual amount of wild life studies.

Such phases of life as adaptations to flight in various phyla, correlation of the activities and exact niches occupied by avian families, such as sunbirds and hummingbirds — these and many

other comparisons will give renewed interest to well-known facts.

My share in the expedition is due to the generosity of Redfield Vose. His single stipulation, that he be permitted to join the party, made the friendly action perfect for the Tropical Research participants.

Rosemary Kenedy is accompanying the party as far as Naples, from where she will visit leading museums in Italy, France and England to study and photograph certain types of neotropical moths. These are the day-flying moths which three members of the department at present are studying. Their larvae show most interesting habits¹ and adults exhibit astonishing examples of mimicry.

The word *Type* is the key to Miss Kenedy's study. The *Type* of any species of animal life is the original specimen from which the first description was made. It is like the original of the

¹ ANIMAL KINGDOM, February, 1954.

Declaration of Independence or an Old Master painting compared with any number of copies. It is a precious possession of the museum in which it is deposited and is never allowed to leave the building. Much of the lasting value of scientific names depends on comparison with the original type. These are the specimens which will be studied and photographed.

The major work will be done with the collections at the British Museum (Natural History), the museums at Tring and Oxford, and with Dr. W. J. Kaye's private collection of Trinidad specimens. In Turin Miss Kenedy will complete arrangements for the shipment of a valuable collection of *Uca* crabs which Miss Crane desires for study in New York.

Henry Fleming will keep the laboratory in the Zoological Park open, and carry on his researches into the systematics of the Ctenuchidae or day-flying moths. He will also begin work on the same family taken in Rancho Grande in Venezuela.

News from the Conservation Foundation

Flood Control Study Is Widely Used

Just a year after publication, our "Flood Control Controversy" has gone into a second printing. Authors Leopold and Maddock, back from a six-weeks' trip to India where they advised on flood control plans and problems, found that the book was actively used in the development of new thinking on flood control problems. They also found it being used in hydraulic laboratories in France and England. Part of the book has been translated into Portuguese for distribution in Brazil.

Arid Lands Conference

Research Director Robert G. Snider attended the Arid Lands Symposium at the University of New Mexico under joint auspices of UNESCO and the American Association for the Advance-

ment of Science and a subsequent conference of experts at the Institute of Mining and Technology at Socorro, N. M.

Water Law in the East

Knotty questions of water allocation are being debated in several State legislatures in the eastern part of the United States — a result of the vastly increased demand for water since the war. This demand is compelling a new look at the way water resources are currently managed and at the present legal basis of water use.

The Conservation Foundation is now analyzing cases and statutes in six representative States in the East. Russell Lord, a writer on agricultural and resource topics, will put the results of the research into popular form for legislators and leaders of industrial, agricultural and urban interests. The project should be largely completed by the end of the year.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Our Congo Peacock Photographs Now Hang in the Congo

Six years ago this mid-June, Charles Cordier came back from a twenty-months' expedition to the Belgian Congo with a plane-load of animal rarities for us, including the first Congo Peacocks (*Afropavo congensis* Chapin) ever exhibited alive. Although they are not uncommon in certain parts of the Belgian Congo, none have been sent out



since that time and our three fine males are still the only ones on exhibition anywhere. Our single female in the original collection was lost as the result of an accident, but

while we still had a pair Staff Photographer Dunton made several excellent photographs of them, one of which Dr. James P. Chapin, the discoverer of the bird, reproduced in his "Birds of the Belgian Congo."

Dr. Chapin is now in the Belgian Congo and a few weeks ago he wrote to say that the Institut pour la Recherche Scientifique en Afrique Centrale (IRSAC) would be pleased to have copies of the photograph to hang in the IRSAC library at Leviro, alongside a panel telling the story of the discovery of the Okapi, another great Belgian Congo rarity. Enlargements have been made and mailed and so visitors to IRSAC can at least see a photograph of the Congo's greatest ornithological prize. To see live Congo Peacocks, they would probably save time and money by making a trip to the Bronx Zoo!

How to Tempt the Appetite of a Callimico

Because we are the first zoological park to exhibit the strange little Callimico, or Goeldi's "Marmoset," *Callimico goeldii*, we have had to chart our own course in outlining a diet for it. This did not appear particularly difficult, since

Let Us Know Where You're Going This Summer

It's perfectly simple for us to send announcements of special events and your copy of ANIMAL KINGDOM to your summer address — if we know what it is. A postcard to Membership Department, The Zoological Park, New York 60, N. Y., will do the trick. You need to tell us only what your summer address will be — when you're going — when you're coming back to your regular address. Three things only.

small monkeys and marmosets thrive on a diet of various fruits and vegetables.

Our first Callimico came from the upper reaches of the Amazon, near the Peruvian border, in mid-December and died just a month later; a second specimen came in March of this year and lived less than a month. Both fed sporadically and sparsely.

On the theory that perhaps a pair would keep each other company and therefore become more quickly and easily adjusted to life outside their native forests, we obtained a lively pair of the animals. Psychologically they seemed well adjusted, but dietetically they followed the same pattern as the previous specimens — banana they ate fairly well, orange juice with vitamins they drank willingly enough, but other fruits and vegetables they scarcely touched.

It is routine to provide small anolis lizards to supplement the fruit diet of marmosets but in this instance lizards were inadvertently omitted from the feeding instructions drawn up by the Veterinarian. After a few days — not realizing that up to then they had been given no lizards at all — he decided to increase their allotment of meat. He thawed two deep-frozen lizards and casually approached the Callimicos.

"I thought those Callimicos were going to break down the front of their cage and leap on me," he said later.

They were frantic in their efforts to seize the little lizards, which they had seen from ten feet away. They chirped and twittered, reached through the wire screen of their compartment, and the instant Dr. Goss offered the food they grabbed it and began chewing as if they had been starved for a week.

Since that time we have routinely given them two lizards a day and their appetites have improved enormously. Hospital Attendant Waltz reported that in addition to the lizards, they ate more than twice their usual amount of fruits and vegetables every day.

The Callimicos are now being cared for by Mrs. Martini in the Animal Nursery until a place is made ready for exhibition. — W. Br.

We Are Attempting to Hatch a Brood of King Cobras

There are records of several species of cobras mating and nesting in captivity and the eggs subsequently hatching. The mating and nesting of the King Cobra of southeastern Asia has never been observed, however, as far as we can discover, until this spring when a female in our collection was seen to mate with one of two males. Thirty normal eggs and 11 small, unfertilized eggs were found in the female's self-made nest of bamboo leaves on the morning of April 25.

All but a dozen eggs were removed the same day for incubation under controlled conditions of heat and humidity, and a few days later the remaining eggs were taken out of the nest when it was found that some, at least, had begun to decay in the extreme dampness of the pile of vegetation.

The eggs being incubated in leaves, moss and damp paper by Dr. Oliver and Headkeeper of Reptiles Spencook are developing normally. No one knows how long it takes King Cobra eggs to hatch but it is probably in the order of six to eight weeks. In any event, from the middle of June onward, Dr. Oliver will inspect the incubating eggs by means of long forceps to lift the protective covering! — W. Br.

New Englanders in the Zoo — 15,600 of Them

For a good many years the bus companies of nearby New Jersey communities have run summertime bus excursions to the Zoological Park. In mid-April the New Haven Railroad ran what turned out to be the first of six special "Zoo Trains" from Connecticut and Massachusetts. They have been successful beyond the most sanguine expectations of the Zoological Park and the railroad.

Each of the six trains has been filled to its capacity of 2,600 persons, so that a total of 15,600



New England arrives at the Zoo

New Englanders were brought on a one-day excursion to us in the past six weeks. The trains arrived at and departed from the Van Nest yards a mile or two east of the Zoo and the passengers were brought to the Buffalo Parking Field in buses engaged by the railroad.

Herbert Knobloch and Miss Marion McCrane of our Education Department accompanied each train on its journey to New York, carrying pet and baby animals and answering questions about the Zoo.

The venture has been so successful from all points of view — particularly that of our visitors, whose enjoyment of the excursion was obvious — that there is a good chance it will be repeated next spring.

IN BRIEF

Teen-age Problem. Two young Steller's Sea Lions were introduced in the Sea Lion Pool recently after a quarantine period in the Animal Hospital demonstrated that they were healthy

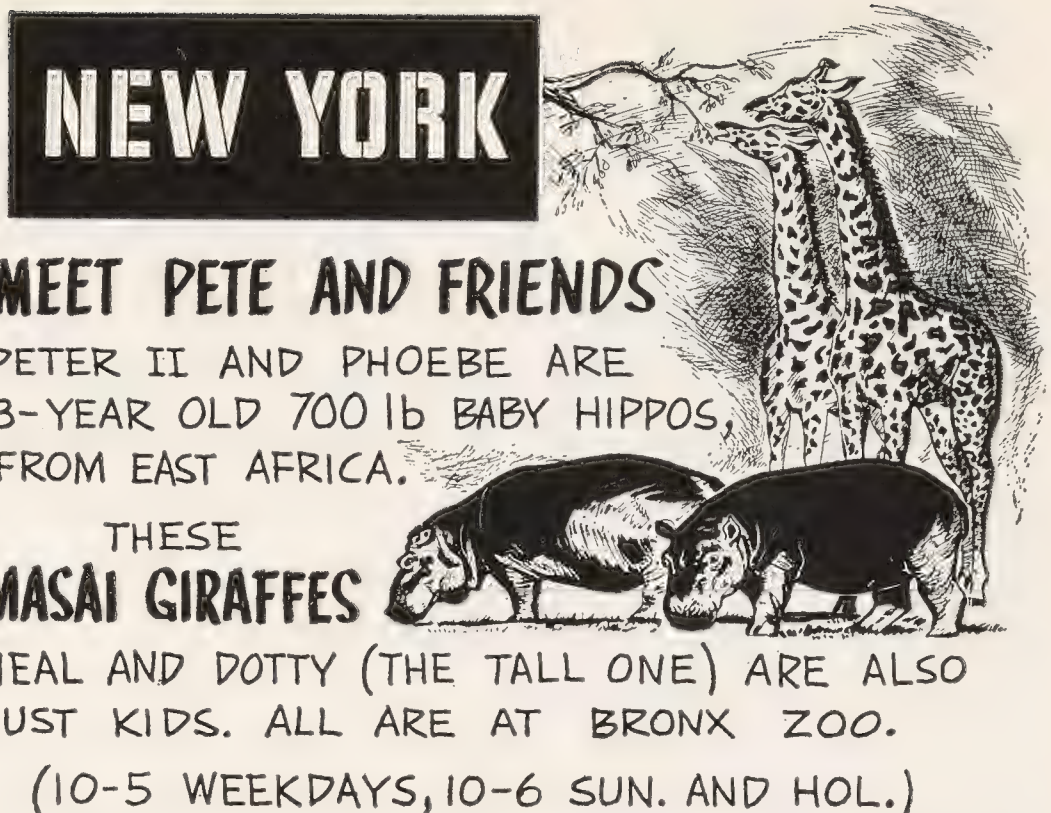
and had a good appetite for fish. No difficulty was expected when they joined the California Sea Lions in the Pool—a large bull, an adult female and their two-years-old offspring, Benny. Trouble did develop, however. Benny has been so aggressive toward the newcomers that they had to be removed. They are again feeding well in the Hospital and will soon be returned to the Pool. If “teen-age” Benny still annoys them, *he* will be removed.

Parking Fee Raised. Parking fees at our four lots have been increased from 35 cents to 50 cents—a rate well below most fees in New York. Members of the Zoological Society get free parking.

New “Little Women.” The four young Chimpanzees in the Great Apes House for the past two years finally attained a size that made it advisable to replace them with smaller specimens. Four new “Little Women”—Amy, Jo, Beth and Meg—went on exhibition on April 16 and they are as playful as only young Chimpanzees can be.

How to Handle a Cobra. Periodically this spring our female King Cobra has exhibited a marked swelling in her neck. It finally became so pronounced that close examination was ordered. Dr. Oliver maneuvered the forward part of the snake into a clear plastic, tube three feet long and three inches in diameter, which safely immobilized it for X-ray examination. Close inspection revealed nothing seriously wrong, although the swelling continues to come and go. There were a few critical moments while Dr. Oliver was urging the snake to enter the tube, but fortunately she is a quiet and gentle reptile and she made no “passes” at anyone.

Holothurin. Together with biochemists from Mt. Sinai Hospital, Dr. Nigrelli has completed a preliminary analysis of the chemical composition of Holothurin, an extremely poisonous substance from a species of West Indian sea-cucumber—a substance discovered and named by Dr. Nigrelli in 1952. Dr. Nigrelli and Father T. D. Sullivan, S.S.E., have found that the lives of mice doomed to an early death by a certain type of cancer can be greatly prolonged by Holothurin. It is, of course, an extremely long step from the laboratory mouse to the human patient, especially when a substance as toxic as Holothurin is involved, but



NEW YORK

MEET PETE AND FRIENDS

PETER II AND PHOEBE ARE 3-YEAR OLD 700 lb BABY HIPPOS, FROM EAST AFRICA.

THESE **MASAI GIRAFFES**

NEAL AND DOTTY (THE TALL ONE) ARE ALSO JUST KIDS. ALL ARE AT BRONX ZOO.

(10-5 WEEKDAYS, 10-6 SUN. AND HOL.)



NEW YORK

CROCODILE FROM THE NILE

THIS TOUGH CUSTOMER FROM EGYPT'S FABLED RIVER IS ONE OF SCORES OF INMATES (RATTLESNAKES, COBRAS, PYTHONS, ETC.) OF THE WORLD'S

FINEST REPTILE HOUSE AT THE **BRONX ZOO.**

(10-5 WEEKDAYS; SUN. AND HOL. 10-6)

Subways all over the city will carry these advertisements during spring and early summer.

the material holds considerable interest for research people.

“Mr. Ramshaw.” The trained Golden Eagle named “Mr. Ramshaw,” which Capt. C. W. R. Knight has used in his lectures here and abroad for several years, has been deposited with us for temporary “boarding.” Keeper Joe Bell of the Aquatic Bird House has been working with the bird, to keep him in habits of obedience. Normally, when not in training, he is on exhibition in the Eagle Aviary.

Memorial Tree. A Japanese Pagoda Tree, a flowering variety, has been planted in the lawn southeast of the Elephant House, in memory of Mildred Levine of the Education Department whose death occurred last year. The tree was acquired by her associates in the Education and other departments.

Approaching the Record. Cecil and Penelope, the Duck-billed Platypuses, are now in their ninth year in the Zoological Park, having arrived on April 25, 1947. David Fleay, the Australian zoologist who brought them to us, kept a platypus for more than ten years in Australia. Our specimens appear to be healthy and in good condition, so that they may eventually exceed Fleay's record. They were put on exhibition on May 7 and may be seen each afternoon between 2 o'clock and 4 o'clock.

Spring "Zoo" Parties. An increasing number of clubs and organizations around the city have formed the habit of holding luncheon meetings in the Zoobar Restaurant in spring or fall. Among them this spring are the American-Scandinavian Foundation, the University Club, the Coffee House, Princeton Class of '09, the Century Association, the Society of Women Geographers and the Bronx Women's Club.

U.N. at the Zoo. Members of delegations to the United Nations from about 50 countries visited the Zoological Park on May 20 and were guests of the Zoological Society at lunch. The visit was arranged by Richard C. Patterson, Jr., the New York City Commissioner of Commerce & Public Events, a new member of the Board of Trustees of the Zoological Society.

THE MORNING'S MAIL

In early April we had a telephone call from the Director of the Zoological Gardens in Kansas City. He was trying to raise money to buy baby Elephants for the Gardens: did we have any motion pictures that would aid the campaign? We have "Let's Look at Elephants," the excellent film made from footage shot in Africa by Saul Blickman, a Member of the Society, and it went to Kansas City by return post. It came back with the following comment:

... We were able to show it to several interested groups, and we had it shown on the TV program which is collecting to buy the baby elephants. I am sure it helped us a lot in obtaining them. An important factor is showing the difference in the African and the Indian elephant, as many people are inclined to think, "They already have elephants, why do they want more?" unless we are able to clearly define the difference. Your film does that admirably. Thanks very much for helping us out. We really enjoyed the film ourselves.

WILLIAM T. A. CULLY
Director

PUBLICATIONS OF INTEREST

ASPECTS OF DEEP SEA BIOLOGY. By Norman B. Marshall. 380 pp. Illus. in color and in black and white. Philosophical Library, Inc., New York, 1954. \$10.00.

Bathyspheres and bathyscapes notwithstanding, practically all our knowledge of what goes on at or near the bottom of the sea must be attained by laboriously lowering for miles the nets and dredges that return with but minuscule samples of what actually exists in the vast depths of the ocean. Putting together the innumerable disjointed facts thus acquired to make a sensible picture of a world we have never seen has many of the attributes of good detective work, as Mr. Marshall shows, both in his review of what other investigators have concluded and in some clever deductions of his own.

The deep-sea investigations of the New York Zoological Society, under the direction of Dr. Beebe, have contributed most importantly to our understanding of deep sea life. More than a tenth of the citations made in this book refer to scientific work done by Dr. Beebe and his collaborators. — J.W.A.

DEVELOPMENT OF COLOR IN BUDGERIGARS. By E. W. Brooks. Pp. 48. All-Pets Books, Inc., Fond du Lac, Wisc., 1955. \$2.00.

The genetic relations of the now numerous color varieties of Budgerigars, or Shell Parrakeets, are extremely complicated and cannot be fully grasped unless it is understood that the only pigments involved are brownish black melanin and yellow lipochrome, the various blues and greens being caused by light reflections from these basic materials. Presence, absence, or degree of intensity of one or both of these pigments and the resulting visual colors are fully and carefully explained by the author in this useful and instructive little book. — L.S.C.

PREHISTORIC ANIMALS. By William E. Scheele. Illustrated by the author. Pp. 128, numerous black and white illustrations. The World Publishing Company, Cleveland and New York, 1954. \$4.95.

This outline of the major animal milestones along the evolutionary road of past ages has many attractive features to recommend it. It is copiously illustrated, but a number of the drawings are so vague as to detract from their value as scientific illustrations. — J.A.O.

ATTRACTING BIRDS TO YOUR BACKYARD. By W. J. Beecher. Pp. 63. Illus. black and white drawings by the author. All-Pets Books, Inc., Fond du Lac, Wisconsin, 1955. \$1.00.

Neatly bound in an attractive hard-paper cover, this little book conveys, at a very small price, more sound and sensible information on attracting birds than is found in many larger and more expensive volumes. In addition to detailed suggestions for planting food-bearing shrubs, erecting bird baths, food platforms and nesting boxes, Dr. Beecher has added descriptions of the common birds of various areas. — L.S.C.

DINOSAURS. By Herbert S. Zim. Illustrated by James Gordon Irving. Pp. 64, numerous black and white figures. Morrow Junior Books, William Morrow and Company, Inc., New York, 1954. \$2.00.

This recent addition to the Morrow Junior Book series is another happy result of the collaboration of Herbert S. Zim and James Gordon Irving — a well-written and well-illustrated elementary account of the dinosaurs and their relatives. — J.A.O.



The YALE as represented in "The Book of Beasts," a Latin Bestiary translated and annotated by T. H. White.

WILD ANIMALS WE WILL NEVER KNOW

WE HAVEN'T any Yale in the New York Zoological Park, and there is no likelihood that we will ever have one. But then there are many other fancied creatures in T. H. White's "The Book of Beasts" which we do not expect to welcome in the Bronx. There are the Phoenix, the Draco and the two-headed Amphivena, to name a few.

In case you don't know about the Yale, it is as big as a horse, black in color, with the tail of an elephant and the jowls of a boar. Its outlandishly long horns may be moved "as the needs of battle dictate." In combat the Yale points one horn forward and holds the other in reserve. Pliny is said to be the first to have described the Yale, but no one is entirely sure what beast he may have had in mind. However, the Yale or Eale became a popular heraldic figure and furnished the supporters for the arms of Christ's College, Cambridge, among other distinctions.

In any perusal of "The Book of Beasts," it is important to realize that every creature included in this translation is there in all seriousness. Ludicrous as some of the descriptions may seem, they

represent the honest beliefs of the chroniclers. As White says, when one first meets up with a Bestiary he is irresistibly reminded of Hilaire Belloc's "A Bad Child's Book of Beasts." However, a Bestiary is a sincere scientific work. These primitive natural histories had no particular authors, but were merely compilations or "a kind of naturalist's scrapbook." Their sources go back to the most ancient of civilizations, to mythology and "ultimately to oral tradition which must have been contemporary with the caves of Cromagnon."

Mr. White, who wrote that charming book, "The Sword in the Stone," claims the Physiologus as the immediate ancestor of his "Book of Beasts." The Physiologus was an anonymous scribe who is thought to have appeared between the Second and Fifth Centuries A.D., probably in Egypt. He compiled this account, possibly in Greek, from which language it was translated into many, many tongues, and was so popular that some authorities believe it to have been next to the Bible in what we now call reader interest.

With its copious footnotes and appendix, "The Book of Beasts" is of concern to us today for it represents what people knew or thought they knew of the Animal Kingdom as late as the 12th Century when the Latin version of Physiologus was compiled, from which Mr. White has translated the work in question.

As members of the New York Zoological Society, perhaps our main point of interest in this book lies in the fact that it has been actually only within the last couple of centuries or so that any substantial body of biological lore has been developed, and prior thereto man was content to pass along old wives' tales about his animal friends. Our Society has, even in its short lifetime, made substantial contributions to our knowledge and will continue so to do.

For instance, this is what "The Book of Beasts" has to tell about Cancer the Crab, and this is all: "Cancer the Crab goes in for a cunning stratagem, due to his greed. He is very fond of oysters and likes to get himself a banquet of their flesh. But, although eager for dinner, he understands the danger, since the pursuit is as difficult as it is hazardous. It is difficult because the inner flesh of the oyster is contained within very strong shells, as if Nature its maker had by her imperial command fortified the soft part of the body with walls. She feeds and cherishes this flesh in a kind of arched dome in the middle of the shell: disposes it, as it were, in a sort of hollow. For this reason, the handling of oysters has to be done carefully, because nothing can open the closed oyster by force, and thus it is dangerous for the crab to insert his claw. Betaking himself to artfulness, therefore, the crab lays an ambush with

a new plot of his own. Because all species delight in relaxing themselves, the crab investigates to find out whether at any time the oyster opens that double shell of his in places remote from all wind and safe from the rays of the sun, or whether it unlocks the fastenings of its gates, so that it may pleasure its internal organs in the free air. Then the crab, secretly casting in a pebble, prevents the closing of the oyster, and thus, finding the lock forced, inserts his claws safely and feeds on the internal flesh."

Shortly a staff member of our Department of Tropical Research will fare forth on a three-year, 'round-the-world pilgrimage in search of further truth about only *one* species of Cancer the Crab!

No, we haven't any Yale and don't know where to find one, and there are many other legendary animals we shall never have in the Zoo. On the other hand there are many more that we shall learn about, either through study here at the Park and the Aquarium or in such research outposts as our Simla in Trinidad or at Jackson Hole.

Over the years the scientific work of the New York Zoological Society has been sponsored by the Society's friends — our members. Below are listed the names of those who have joined or changed in membership status since the last issue of this magazine.

New Members of the New York Zoological Society

Life

B. W. Haxall
George W. Merck, Jr.
Hon. Richard C. Patterson, Jr.

Contributing

Ethan Allen
Mrs. Ethan Allen
William D. Barry
Mrs. Robert E. Burns
Kenneth Caron
Mrs. William Andrews Clark
Mrs. Henry B. Coakley
C. N. Wentworth Cumming
Dr. Douglas S. Damrosch
Dr. William E. Davis
Wilbur Downs
Mrs. Wilbur Downs
John E. Dumaresq
Mrs. Francis P. Garvan
Mrs. Arthur Gengler
Jerrold Greenberg

Dr. Portia Hamilton
John E. Heintz
Edward K. Hessberg
Isaac Lapidus
Miss Janet S. Lippencott
William A. Lockwood
Mrs. John Mayer
Mrs. Charles J. Nourse
Samuel Revits
Mrs. June Havoc Spier
Harry Staub
Harold Steiger
Mrs. Huntington M. Turner
Mrs. Taggart Whipple

Annual

Mrs. L. R. Breslin, Jr.
Gerald J. Creighton
Miss H. S. Curtis
Mrs. Jane Quinn Davis
Miss Else S. deBrun
John V. N. Dorr

Mrs. Jules Ehrich
Miss F. Belle Figger
John Ripley Forbes
Kelly Fox
Robert G. Fredericks
Mrs. Rodman Gilder, Jr.
Harold W. Gillen
Miss E. L. Godwin
Miss Elizabeth Hirt
Al Katz
Joseph N. Kessler
Mrs. Yale Kneeland, Jr.
Herbert Wilson Leff
Mrs. Robert J. Lewis
William H. Meeder, Jr.
Thonglaw Punyanitya
Gary Lawrence Sherman
Max Siegel
Miss Myrtle A. Sperber
John J. Teal, Jr.
William W. Vandivert
Mrs. Eliot B. Weathers
Charles L. Weinberg



Komodo Lizards may not be exactly Dragons but they *look* like Dragons and are plenty big enough. Two are due from Singapore any time now.



Did you ever see a Gerenuk? Odd-looking antelope with a great, long giraffish neck. One of these is coming along.



"Mr. Ramshaw," Captain Knight's trained Golden Eagle that you have probably seen at members' meetings, has retired from active practice and come to live in the Eagle Aviary. It is *not* expected that he will write his memoirs.

Hark! Hark! The Sea Lions bark! The little family in the Seal Lion Pool is being augmented by a pair each of the great Steller's and the usual California Sea Lions.



Besides a fine young bull Bison, there will be, "too numerous to mention," birds, mammals and reptiles that just by the nature of things come into the Park in the next few months — including the young animals that will be born here.

ALL these new creatures do not come at once — fortunately for us, for almost every one of them will need special attention on arrival. However, they will be along, and Society members will have notice of the approach of the more important ones. It is hoped that they will mostly be on hand on Garden Party Day for Society members. If you are not a member you can join now and come to see these fascinating new exhibits in a leisurely fashion some pay-day when your members' card lets you in for free.

Special Suggestion: Why not make up a Zoo party — your own expedition — and arrange with our Education Department at the Zoo (Telephone WELLington 3-1500) for a Guided Tour to see all the new animals? This is a service we are pleased to give to members free of charge.

WILD ANIMALS YOU CAN KNOW

And Soon

AN UNUSUALLY large number of interesting new animals are coming to the New York Zoological Park (Bronx Zoo) in the next few weeks. We plan to alert members of the New York Zoological Society at their approach.

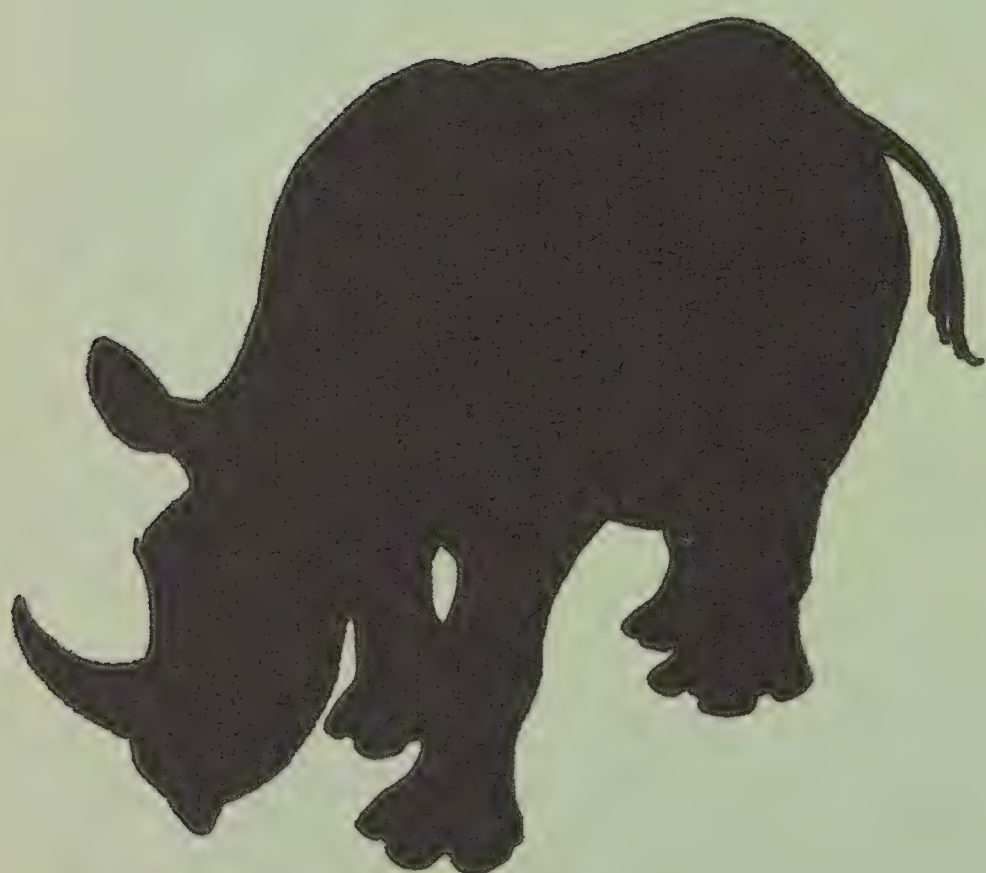
Watch for these announcements. Come to see these rare new exhibits soon.



Here for the first time we will have *Ovis poli* or Marco Polo's Sheep—the largest of all sheep species — bigger than the biggest Bighorn of our own Rocky Mountains.



We expect to show a pair of Callimicos in the Small Mammal House. These are also First Timers — very delicate, marmoset-like creatures.



Among the exciting new babies there will be an infant Walrus — possibly two, but one will be sufficient if his charm matches up to that of our beloved, inimitable Herbert. And another not-likely-to-be-so-endearing baby will be a young African Black Rhinoceros, to take the place of truculent Joe, the Tough Guy of the Elephant House.



"COME UP AND SEE ME SOMETIME"

And this is how to get here:

AUTOMOBILE. *From east New York City and Long Island:* East River Drive N. across Triboro Bridge; Northeast on Bruckner Blvd. to Bronx River Parkway; North to Exit 5 for Bronxdale Parking Field of Zoo, or Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field.

From Long Island: Across Bronx-Whitestone Bridge, continue on Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), thence W. to Zoo.

From west New York City and New Jersey via tunnels: Henry Hudson Pkwy. N. to Dyckman St. and Broadway; N. on B'way to 207th St.; turn E. on 207th St., Fordham Rd. and Pelham Pkwy. to Zoo.

From New Jersey via George Washington Bridge: Through tunnel at east end of bridge, up ramp marked "Bronx-Bronx

Whitestone Bridge," E. to University Ave., N. on University to Fordham Rd., E. on Fordham to Zoo.

From Westchester and Connecticut: Merritt Pkwy. S. to Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), OR Bronx River Pkwy. S. to Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field, or Exit 5 for Bronxdale Parking Field.

From western Westchester and upstate: Sawmill River Pkwy. S. to Mosholu Pkwy., skirt Botanical Garden southward to Pelham Pkwy., turn left to Pelham Pkwy. gate and Fountain Circle Parking Field.

SUBWAY. *West Side (IRT):* Northbound East 180th St. Express to 177th St. Walk N. to Zoo.

East Side (IRT): Northbound 241st St.-White Plains Rd. Express OR East 180th St. Express to 177th St. Walk N. to Zoo.



ANIMAL KINGDOM



SMITHSONIAN
OCT 21 1955
LIBRARY

590.673
A59

THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT Fairfield Osborn	VICE-PRESIDENTS Alfred Ely Laurance S. Rockefeller Donald T. Carlisle	SECRETARY Harold J. O'Connell	TREASURER David H. McAlpin
		ASSISTANT TREASURER Percy Chubb, 2nd	

EXECUTIVE COMMITTEE

Laurance S. Rockefeller
Chairman
John Elliott
Alfred Ely
Robert G. Goelet
De Forest Grant
Warren Kinney
David H. McAlpin
Robert Moses
Harold J. O'Connell
Fairfield Osborn

Class of 1956
Archibald S. Alexander
A. Raymond Dochez
Robert G. Goelet
De Forest Grant
Eugene Holman
Warren Kinney
William De Forest Manice
Harold J. O'Connell
Landon K. Thorne
J. Watson Webb

BOARD OF TRUSTEES

Class of 1957
Robert E. Blum
Percy Chubb, 2nd
C. Suydam Cutting
Alfred Ely
Marshall Field
Childs Frick
Henry Clay Frick
Archer M. Huntington
David H. McAlpin
Richard C. Patterson, Jr.
John H. Phipps

Class of 1958
George F. Baker, Jr.
F. Trubee Davison
John Elliott
Robert I. Gannon
Peter Grimm
Fairfield Osborn
Eben Pyne
Laurance S. Rockefeller
Archibald Roosevelt
John M. Schiff
Henry Sears
Edwin S. Webster

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Grace Davall . . . *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandal *Assistant Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch . . . *Assistant Curator, Education*
Quentin Melling Schubert *Superintendent,*
Construction and Maintenance
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. . . *Research Associate in Ichthyology*
Harry A. Charipper . . *Research Associate in Histology*
Homer W. Smith . . *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges . . . *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez Caryl P. Haskins
Alfred E. Emerson K. S. Lashley
W. A. Hagan John S. Nicholas

AFFILIATES

C. R. Carpenter, *Co-ordinator*
Animal Behavior Research Programs
L. Floyd Clarke, *Curator*
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen Samuel H. Ordway, Jr.
George E. Brewer, Jr. Hugh J. Ross
Donald T. Carlisle Robert G. Snider
John C. Gibbs Peter M. Stern

459

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

Oka—Our 315 Pound
Gorilla *Sam Dunton* Cover

Nature Spreads a Varied
Table
William J. Hamilton, Jr. 98

The Black Howlers of
Barro Colorado
Charles H. Southwick 104

Mid-summer in the Zoo
Photos by Sam Dunton 110

A Rattlesnake's Strike
Henry M. Lester 116

We're Sorry for
Andrew Burr, Jr. 123

News from the
Conservation Foundation 125

Behind the Scenes 126

Vol. LVIII AUGUST 1955 No. 4

Jubilee Days at the Zoological Park

THIS IS A TIME OF JUBILATION. Just now we are establishing some new records, each of them, it so happens, connected with animals bearing royal names. Two months ago our King Cobras mated and today there are nine little "princes," the first time in zoological history that the foes of "Rikki-tikki-tavi" have been known to breed in captivity. A few weeks later, our King Penguins mated and at this very moment are incubating a royal egg which, royal or not, we hope will hatch in mid-August. To cap the climax, we now possess two Emperor Penguins, the only ones alive today in any zoo in America, captured last winter in the polar wastes of the Antarctic. In regard to these Emperors, we are deeply sorry for the misfortune of the Washington Zoo through whose kindness we obtained our two birds but whose own Emperors, unhappily, have not survived. At the moment ours appear well and we are hoping for the best as to their continued good health.

Keeping wild animals which come to us from furthest parts of the earth and from regions of varying climates is a delicate business and one that requires unusual skills. The episodes cited above do indeed represent triumphs in the art of zoo management in which the skills of our staff and keepers are intimately involved. After all, our primary duty is the welfare and contentment of our remarkable animal collections. It is because of them that our Zoo has attained its great name.

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

NATURE SPREADS A

VARIED

TABLE

By

William J. Hamilton, Jr.

Professor of Zoology, Cornell University



IT IS RECORDED in the publications of the New York Zoological Society that approximately 150 kinds of food are more or less regularly on the menu served to the Zoo's wild animal collection. The figure is impressive, and bespeaks an admirable concern for finicky tastes. But it pales to insignificance in comparison with the variety of foods that animals choose to eat in the wild — or are forced to eat.

The fact is that the food of wild animals is usually dictated by availability. Most species have a catholic taste and eat that which is most abundant. Our Red Fox, with a formidable dentition presumably modified for a carnivorous fare, utilizes the seasonable foods at will. While mice and rabbits sustain the fox during the cold season, the blades of winter wheat, pushing above the shallow snow, may stay its hunger when more favored delicacies are not to be had. Strawber-

ries, blueberries and other fruits are utilized in the summer months. Most of our native mice, whose teeth might well stamp them as vegetarians, are highly insectivorous; meat may occasionally account for a large share of the food. The Myrtle Warbler, like others of its kin, has a rather weak bill modified for a diet of insects. More hardy than others of the warbler family, it often winters in our northern states, subsisting on the hard-shelled bayberries and dried fruits that sustain it when insects have disappeared. It is impossible to ascertain the probable diet of many common species merely by an examination of the teeth, the bill or mouth parts, used in food getting.

Many animals exhibit an ecological plasticity, adapting their diet to other items when a favored food is absent. Few vegetarians illustrate this better than our Red Squirrel. On the Cornell

University campus, the large elms provide an abundance of swelling buds in the early spring, and these are eagerly consumed by the squirrels. The sprouting samaras of the past year are dug from beneath the maples. The flowers of many trees are eaten as they open. Twig cutting commences as the blossoms go to seed; the ground below will often be covered with the terminal tips of limbs, only a few blossoms or seeds of which have been removed. This lavish feeding is notable, not only with the squirrel, but with many other species as well. This behavior has a real significance. For whatever the crop the squirrels enjoy at a given time, be it acorns, seeds or buds, is at that time far in excess of their needs. It behooves the squirrel not so much to conserve its food but rather to cultivate a varied appetite and wide knowledge of what is good to eat and where to find it, so that failure of any food source at any particular time of the year or in any particular year will not find it at a loss as to where else to turn for sustenance. The oft-repeated statement that tree squirrels are dependent upon the mast crop, and decline in numbers when the nut crop fails, is without foundation. For these adaptable creatures have a truly varied diet, and manage well in spite of a short crop of a favored food.

Relatively a few animals are monophagous. Any herbivore, narrowly specialized in its dietary, must necessarily be restricted in its distribution to that of its specific food plant. A catastrophic disease, eliminating the principal diet, would necessarily spell doom to the dependent feeder. Specialized forms cannot adapt themselves in a quickly changing world. If some insect, plant disease or other agent should eliminate a plant which alone serves some animal, the creature would pass with it. Fortunately no such strait faces the cecropia, eucalyptus and other food plants of which I am aware. Our American elms, now seriously threatened with phloem disease and attacks by the Dutch elm beetle, fortunately do not provide the major sustenance for a single vertebrate species. The Baltimore Oriole, utilizing the long drooping branches for its nest, may become less common if our elms should disappear; it could probably adapt itself in time to less favored trees.

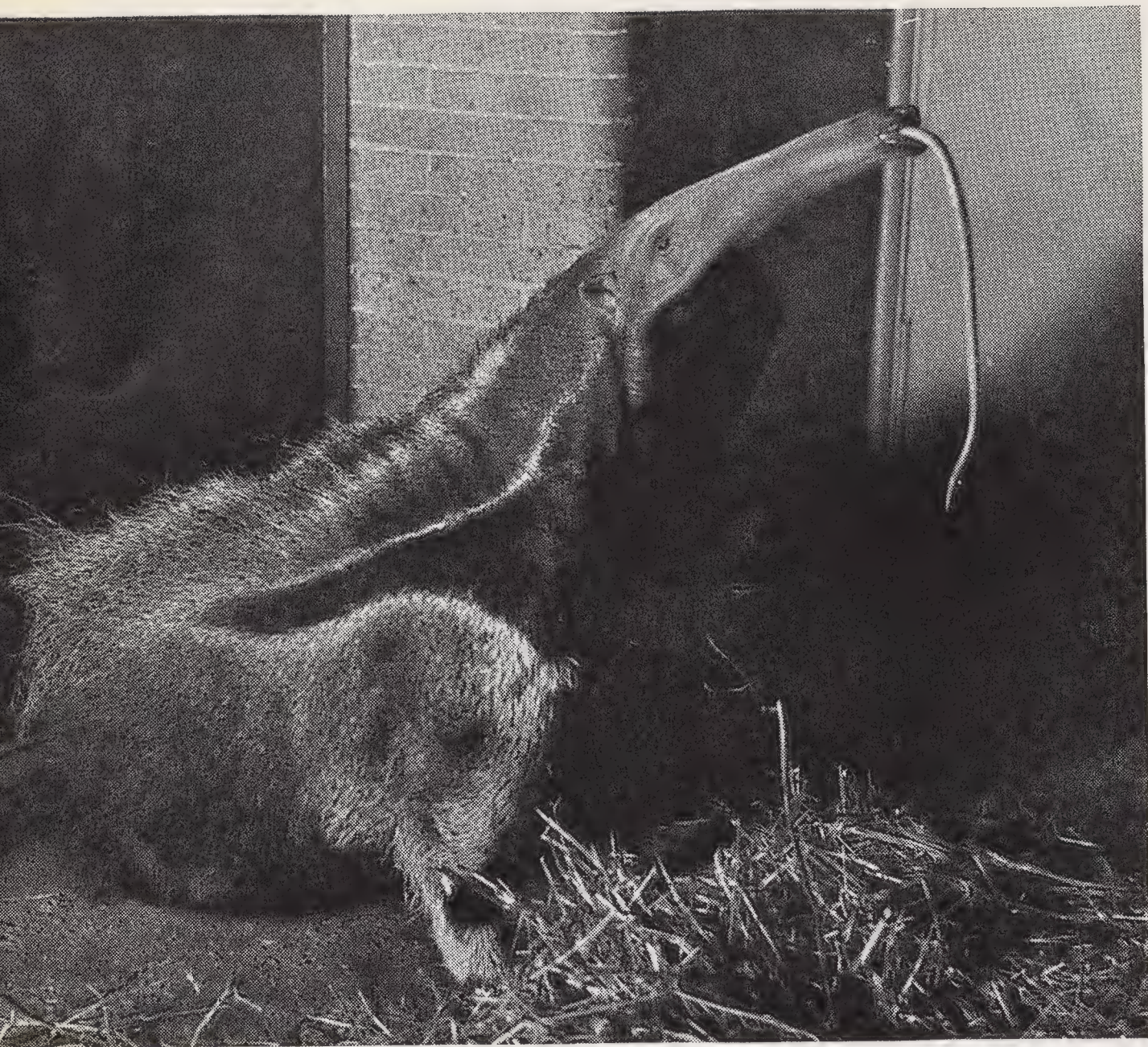
The Koala, almost the trademark of Australia,

has probably been publicized as much as any mammal. It and the kangaroo are synonymous with the continent down under. But while kangaroos are standard exhibits in any large zoological park, very few Koalas have been seen alive outside their native land — chiefly because of their highly specialized diet. In the wild state, the Koala feeds only on the leaves of the eucalyptus. So specific is this diet that trees of the same species are favored over others. The effect of soil and probably the nutritional content of the leaves on the Koala's choice has been pointed out by Burnet.¹ The shoots and leaf tips of some gum trees may actually give off a volatile poison (prussic acid) in toxic quantities. Few animals are so bound to a specialized food in restricted localities as the Koala. The Australian zoologist, Troughton,² indicates that here is a creature whose drastic shrinkage in numbers may be attributed, in no small measure, to the clearing of certain favorable food trees.

Our American tropics provide some interesting specialists. The great bushy-tailed anteater, lacking teeth, must utilize its long, viscid tongue to probe the ant hills and termite tunnels for a diet of these creatures. Its powerful fore claws, ripping apart the tortuous tunnels and cavities that harbor these delicacies, make way for a gluttonous repast. Enders³ remarks on the way the tongue is employed by the three-toed anteater. He states that this organ is capable of following a tunnel to its end, then passing over to a parallel tunnel; the tongue tip may clear the cavity by moving in a direction opposite from its base.

Yet another of our tropical mammals leads a restricted life in several respects. The Three-toed Sloth feeds solely on the leaves and buds of the cecropia. Lacking this primary favorite, the creature will eat leaves of the hog plum tree, *Spondias*. It is said that the mother weans her young on the predigested leaves of the cecropia. The Giant Panda of southeastern Asia, a relative of our raccoon, subsists almost exclusively on bamboo shoots. But even the specialized feeders may become adjusted to a zoo diet of substitutes if the change be made gradually.

Our own American Tree Mouse (*Phenacomys longicauda*) lives among the evergreen forests of the Pacific Coast. According to Howell,⁴ the normal food consists solely of the fleshy part of



the needles and the bark from the tenderest growth of the fir twigs. A terminal twig, preferably of Douglas fir, is severed, each needle removed and the medullary part eaten, while the sides and resin ducts are discarded. The uneaten portions are either dropped to the ground or added to the large tree nests. Captive mice may eat freely of many substances, but if deprived of these needles they soon languish and die.

The Florida swamps and waterways nurture two specific avian feeders. The food of both the Everglades Kite and the Limpkin are largely restricted to the snail, *Ampullaria*. Colonies of the kite, or Snail Hawk, are necessarily restricted to the haunts of this molluscan. The unbroken shells are discarded beneath the bushes in the regions where this bird is numerous, and give indubitable proof of its presence. The Limpkin, probing the mud for the embedded snails, snatches the creature from its retreat, twitches off the operculum and deftly extracts the body from its hard covering. These birds do not appear modified for a specialized diet. Indeed, the Roseate Spoonbill, another Florida citizen, with its peculiar spatulate bill, appears far more specialized, yet its diet is not restrictive. Moving the partially opened bill to and fro through the shallow water and soft mud, these handsome birds secure small minnows, aquatic insects and shellfish.

So far as is known, all snakes are animal feeders, although Barbour⁵ suggests that the narrow-mouth fossorial species of the Typhlopidae may eat caterpillar dung. While snakes may utilize the vegetable contents of their prey, it is a rare instance when one feeds directly on plant food. Some species are rather restricted in their diet, including in their fare a relatively few items. The little black-headed snakes, *Tantilla*, feed primarily on centipedes; a large series which I have examined from Georgia had eaten these invertebrates alone. The common Red-bellied and DeKay's Snake of our northeastern states utilize slugs in high degree. Perhaps the most specialized of all are the egg-eating snakes of Africa.

The Giant Anteater of the American tropics uses its long, viscid tongue to probe ant hills and termite tunnels and extract its food. It has no teeth.

Bamboo shoots, leaves and twigs are favored by the Giant Panda in the wild, but in the Zoo it can be induced to take some supplementary food.

A two-foot individual can swallow a hen's egg. The young of these snakes are not so specialized, for their teeth, unlike the adults, are adapted for grasping less passive food. It is well that the youngsters are so adapted, for there is a limit to the size of eggs they can swallow during their infancy.

Lizards are for the most part carnivorous or insectivorous, although this group provides a few notable exceptions. The Marine Iguanas of the Galapagos Islands are social-minded creatures, hundreds gathering on the rocky shores and entering the water to feed on the seaweed. These islands support another large lizard, which Darwin observed feeding on succulent cactus and the leaves of various trees. Our own Chuckawalla, a large lizard of the southwestern desert, presumably feeds entirely on plant matter, utilizing tender leaves, flowers and fruit.

Frogs and toads are largely dependent upon water, most species utilizing the ponds and slow streams for breeding activities in the spring. The aquatic larvae are as diverse in their feeding habits as in the form of their bodies. Transformation to the adult, with attendant modification



of the mouth and the alimentary tract, provide an immediate change to an animal diet. Dependent upon size, these tailless amphibians seek their own niche but few become specialized feeders. The little narrow-mouthed toad favors the ant billions that occur in its realm. Night collecting in southern Florida often reveals this little fellow, its snout poked in an ant tunnel, intent on a formicine feast.

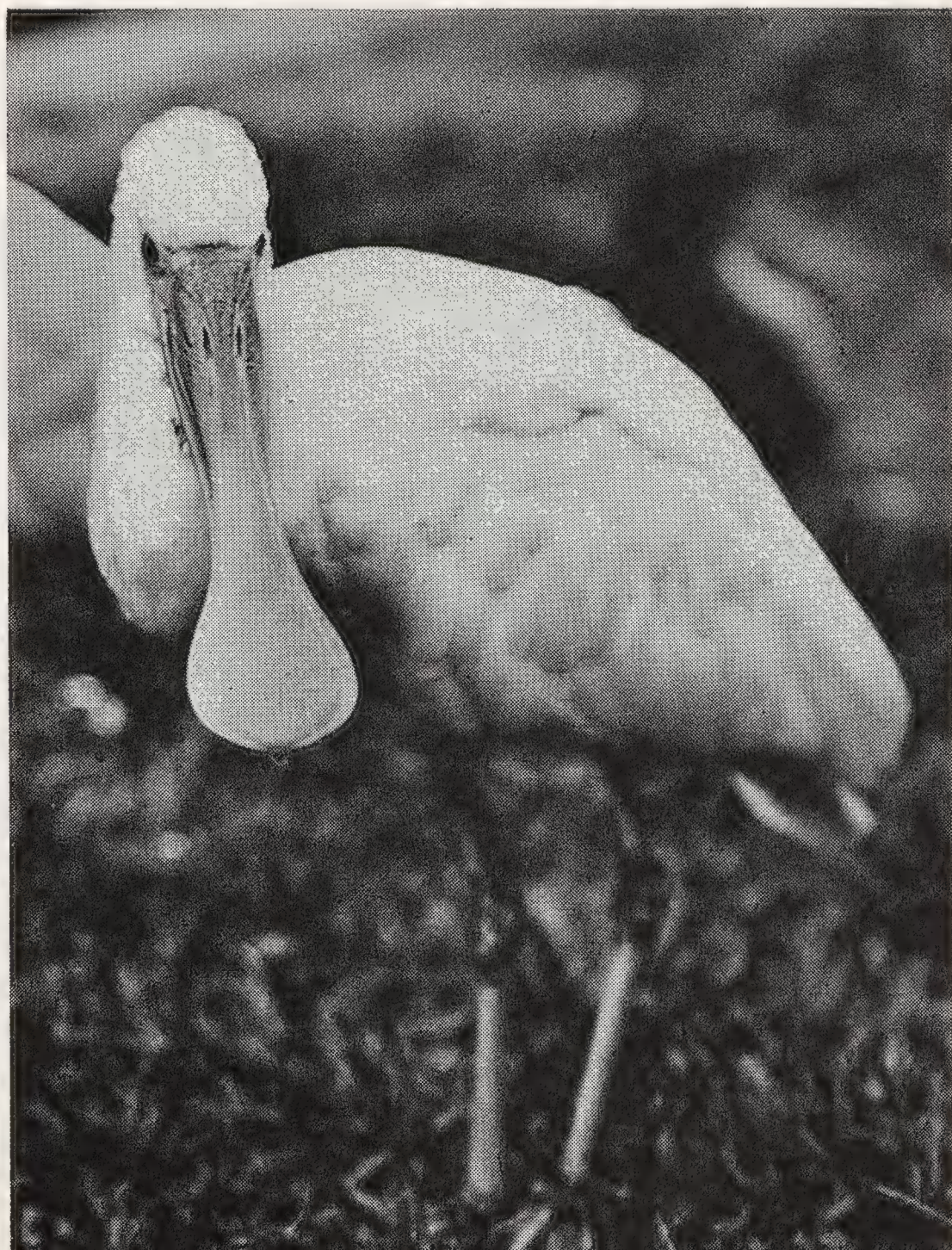
Our larger frogs disdain such minute food; they are as adept and versatile in feeding pattern as other vertebrates. Any creature of a size that will satisfy the all-embracing appetite is a probable meal. Some, with cannibalistic traits, wait on the shore line to grab the helpless transforming young. Nor do they spurn the rats, birds and other prey that happen to alight within reach of the huge jaws. Our southern states spawn the mottled Gopher Frog, a rarity to most collectors except during the spawning chorus. This fellow,

The Roseate Spoonbill would seem to be restricted in diet by the peculiar shape of its bill, but actually it can pick up many kinds of food with ease.

with giant gape, downs any hapless relative who ventures near his chosen burrow. Most diminutive of all frogs — perhaps the world's smallest, the diminutive *Hyla ocularis* of our southeast — is content with the small insects which venture in range of its viscid tongue.

Our native Opossum is no epicure, feeding on a wide variety of fruits and flesh. But its distant cousin, the tiny Australian Honey Possum, so small that it can snuggle in an average-sized pill box, is far more particular about its food. In these diminutive creatures, the snout is lengthened into a long narrow proboscis for thrusting into blossoms, while small flanges on the lips overlap to form a channel through which the beast sucks up pollen, nectar and tiny soft-bodied insects. The feeding is aided by a slender tongue, equipped with bristles, that can be extruded well beyond the snout. This structure acts as an excellent brush to sweep up the sticky food. In such a specialized feeder, we usually find a corresponding degeneracy in the teeth, which eventually become designed only for masticating fruit pulp, honey and soft animal matter.

A similar situation prevails in some species of bats. These little flying mammals are primarily insectivorous yet in the tropical areas of the world specialized feeders are not uncommon. *Choeronycteris* of our own tropics delights in large blossoms, reaching the base of the flower with its long tongue or licking out soft juices and the pulp of fruits. It is admirably adapted for



such a diet. Like the Honey Possum, its snout is long and narrow and the long extensile tongue has a little brush at its tip. A further modification of this flower feeder is found in the absence, at least in some species, of the lower incisor teeth, facilitating free play of the tongue. Some of these bats undoubtedly play a part in the cross-pollination of night-blooming plants.

Thus one finds a counterpart with some of the nectar feeding birds, notably the Hawaiian honeycreepers. The brush-tipped tongue of *Drepanis* serves the same function as in *Choeronycteris*, probing the tubed flowers of lobelias. Our hummingbirds are another group which utilizes the nectar and the tiny insects which in turn are attracted to this sweet food.

One of the most remarkable feeding traits of all is found in the sand shark, *Carcharias taurus*. Stewart Springer⁶ found that great numbers of eggs, up to 24,000, are produced by a large female. In spite of this huge production, only two embryos develop. As they reach maximum size, one to each oviduct, the young become active and commence to feed before they are expelled into the sea. The undeveloped eggs are eaten while the embryo is still within the oviduct. Here is a species that sends forth into the world not only well-developed large young, but babies with a full stomach. Springer surmises that birth may proceed as a direct result of a hunger drive on the part of the embryo, which causes it to reverse its direction when egg production falls below a satisfactory level.

Some animals rely upon other species to harvest their food. The Lucifer Hummingbird, a rare visitant to our southwest, feeds at flowers

like our Ruby-throat, but it also visits the larger spider webs to remove the small insects which have been snared. These feathered sprites must exercise care for they, too, might be trapped by the predacious spiders.

The Remora, equipped with a modified dorsal fin that provides a convenient suction disk on its head, attaches itself to a shark. When the host makes a kill, the Remora leaves its benefactor in order to feed at the same table. Particles too small for the shark are utilized by the shark sucker.

Many quaint stories are credited to the Greek historian, Herodotus. Among others, he mentions a species of plover (probably the Black-billed Courser), slipping into the gaping jaws of the Nile Crocodile to pick off leeches which infest the gums of these huge reptiles. At the same time, the birds glean bits of food from the teeth. Perhaps this story has a basis of fact, for the birds do sit on the basking "crocs." Since these reptiles, while resting, often lie with the jaws parted, it is not beyond reason to suspect that the birds utilize the scraps found in the gums of the crocodile. To be sure, the plover would not be dependent on this source alone for its sustenance.

Few feeding habits are more bizarre than the twice-fold eating of a meal. Wolves will often gulp such a quantity that they must vomit the stomach contents, to eat more leisurely the previously ingested food. This is not so with rabbits. Some species, as the European rabbits, ingest the feces. Southern⁷ watched wild rabbits eat the droppings as they were extruded. Possibly this phenomenon is associated with severe winter weather, when perhaps the animal must perforce



utilize the digested food again. Crowcroft⁸ found this same situation to prevail in the shrew, *Sorex araneus*. The rectum is everted, the contents eaten and the structure inverted to its normal position. Possibly, as Bourlière⁹ suggests, this habit provides the creature with large amounts of vitamin B produced by bacteria in the food within the large intestine.

How little we yet know of the feeding habits of our common animals and how much is to be learned! This habit of "refection" or coprophagy, as it is termed, is common to the domestic rabbit, possibly to many other mammals.

No less interesting than the food itself is the manner of securing it. Lures are employed by many species to entice the unsuspecting prey within range of the jaws.

The fabled Angler or Goosefish, a bottom feeder of the North Atlantic, employs a curious device to snare smaller fish into its capacious maw. The modified first dorsal spine has worm-like tentacles on its tip and arises from the snout, far forward from the usual position of most fish. Normally it lies against the back. When a small fish approaches, the "rod" is moved forward, the lure is activated and the unsuspecting prey, swimming ever closer, is swept into the mouth. Occasionally forsaking the rubble bottom, a large Angler will surface to snare an unwary gull or sea fowl.

The muddy lagoons of the Mississippi harbor our largest fresh water turtle, the giant Alligator Snapper. Individuals attain a weight of 200 pounds; the tremendous head may measure eight inches across. Less active than its smaller cousin, the common Snapping Turtle, this great reptile has devised a unique manner to attract smaller creatures within range. The tongue supports a peculiar distensible growth, somewhat wormlike in appearance, that stands out in relief from the dark tissues of the mouth. Those which I have observed were dull gray in color. When fishing, the mouth is open, the bifurcated lure is wiggled slowly and the turtle patiently waits for a meal. Hidden in the detritus of the bottom, its cara-

pace often camouflaged with a mat of algae, the reptile is not easily recognizable, and thus the bait ultimately attracts a fish. One nibble at this prospective meal, and the victim itself is dispatched by this living trap.

I have long been intrigued by the manner in which the Red Squirrel carries various fungi to the trees, placing them in a forked branch for curing, later returning to replete itself on the stored food. I urge the reader not to accept Walton's account in his otherwise delightful story, "A Hermit's Wild Friends." He declares that only those fungi stored by the squirrel are fit for human consumption, and followed the dictates of choice laid down by this little red fellow. Unfortunately, the cache is often made up of *Amanitas* which contain an alkaloid poison virulent to man. One writer remarks that the fly amanita was responsible for the death of Czar Alexis of Russia, yet the squirrel utilizes it as a food. *Russula* is another fungus that is consumed by the squirrel, but human beings must beware of this deadly genus. Bourlière includes *Russula* in the dietary of the Roe Deer. He credits Hediger¹⁰ with the observation that exotic ruminants often poison themselves by eating *Solanum nigrum* (a poisonous plant common in our own country) that native Chamois and Ibex instinctively avoid.

From this summary account of some animal diets, one thing stands out: Nature may not always provide a bountiful table for all her children, but she does offer almost infinite variety.

¹ Burnet, Noel — quoted by Ellis Troughton, p. 134 of "Furred Animals of Australia," 1947.

² Troughton, Ellis — as in footnote 1.

³ Enders, Robert. 1935, Mammalian Life Histories from Barro Colorado Island, Panama. Bull. Mus. Comparative Zool., Harvard College, vol. 78 (4): 494.

⁴ Howell, A. B. 1926, Voles of the genus *Phenacomys*. North American Fauna, 48. Washington.

⁵ Barbour, Thomas. 1926, "Reptiles and Amphibians." Houghton-Mifflin, p. 40.

⁶ Springer, Stewart. 1948, Oviphagous embryos of the sand shark, *Carcharias taurus*. Copeia, No. 3, Sept., pp. 153-157.

⁷ Southern, H. N. 1940, Coprophagy in the wild rabbit. Nature, vol. 145, p. 262.

⁸ Crowcroft, Peter. 1952, Refection in the common shrew. Nature, vol. 170, p. 672.

⁹ Bourlière, François. 1954, "The natural history of mammals." Alfred Knopf, p. 41.

¹⁰ Hediger, H. 1950. "Wild animals in captivity." London, Butterworths. 207 pp.

Prey-attracting lures that are part of the predator's body, as in the various angler fishes, are a curious adaptation to food-getting. Here a small fish is approaching the extended, worm-like tentacles.

The Black Howlers of Barro Colorado

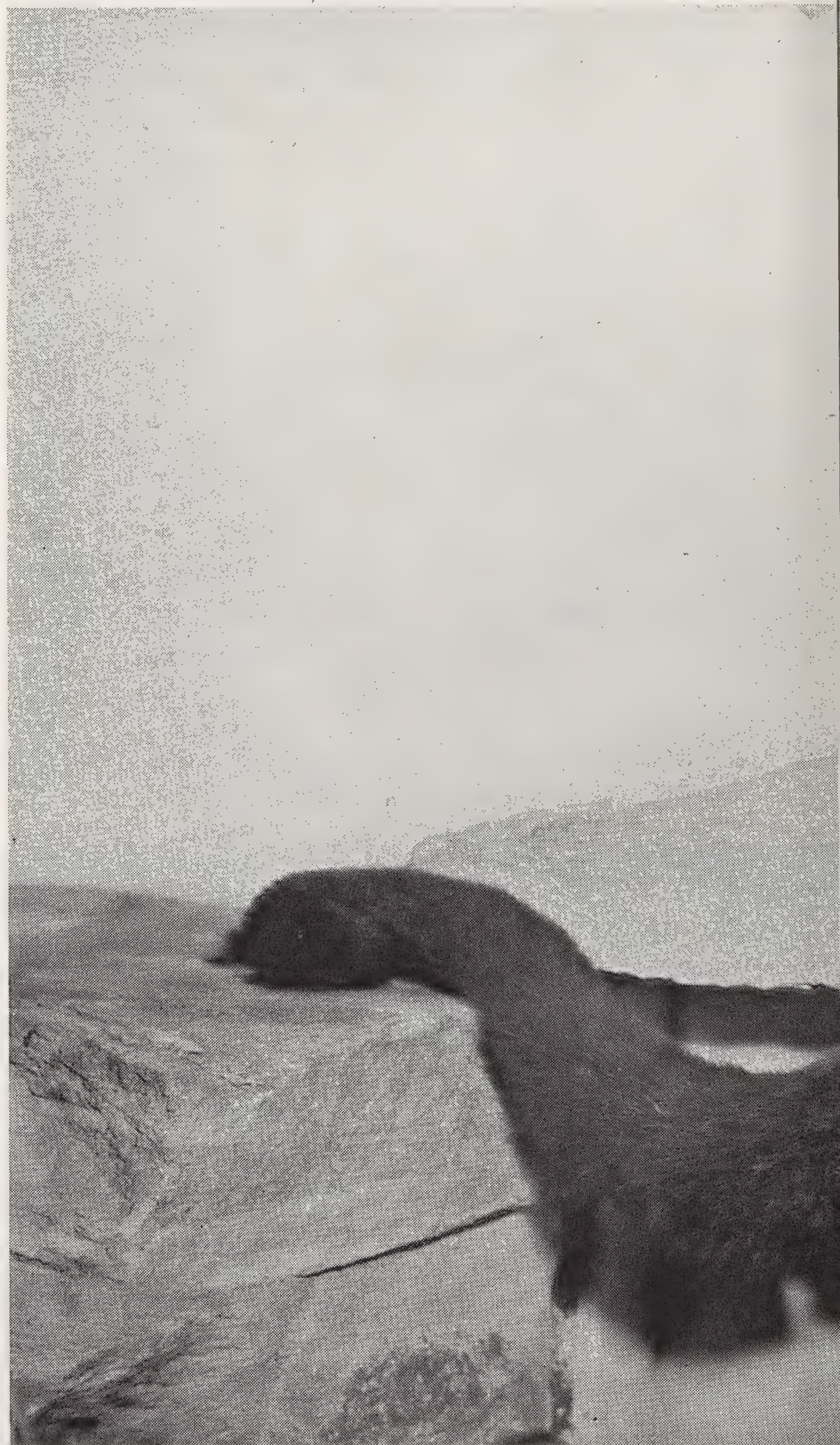
By CHARLES H. SOUTHWICK

Department of Zoology, Ohio University

I SHALL NEVER FORGET my first morning's experience with the Black Howler. I had arrived on Barro Colorado Island, in the Panama Canal Zone, on a warm evening in early March. Dr. Nicholas Collias and I arose at 4:30 o'clock the following morning, and an hour later we were half a mile from camp waiting in the dark quiet of the predawn tropics. Our breathing, after we had climbed numerous hills and pitched into uncounted ravines, was the noisiest sound to be heard. By 5:45 o'clock the blackness was diluting and we were able to make out nearby tree trunks draped with woody vines. Off in distant ravines, a Great Rufous Motmot hooted several times, with slow and hollow tones. The shrill wavering whistle of a tinamou came from an undeterminable distance. Then the air was torn and our ears were buffeted by the roar of the howler monkey. I had read about it, I had imagined it, I had even heard it recorded, but none of this had prepared me for hearing the howler's call in the wild.

As the first male of the morning began his howling almost directly over us, other males, some distance away, answered his vocal challenge. The howling filled the air, then ceased, then began 400 yards away, was answered, and resounded from male to male until we had distinguished half a dozen individuals entering into the chorus. Occasionally the sharp, terrier-like whine and bark of the female could be heard. By 6:30 o'clock daylight had come, and all was quiet. The hooting of the motmot ceased, the whistle of the tinamou was heard no more, and the monkeys settled down to their day of sleeping, moving and eating.

HOWLING (or howler) monkeys have been called the most impressive of the American primates. Certainly they are the largest New



World monkeys and adult males attain a weight of as much as 26 pounds, with the scarcely smaller female averaging 15 to 18 pounds. But these statistics are weak when one has seen howlers in the wild. There, for some reason, they appeared — to me, at least — to be much larger than their recorded weights would indicate. Perhaps my sense of size was distorted by the grandiose proportions of the tropical forest.

Howlers range from the jungles of Guatemala and Vera Cruz to the southern limits of Brazil and there are two species and a number of forms; the Black Howler (*Alouatta palliata*) is most common in the northern part of the range, while the Red Howler (*Alouatta seniculus*) becomes abundant in the valleys of the Orinoco and the Ama-



zon. Neither the Black nor the Red is likely to be very familiar to the zoo-going public, for howlers are extremely difficult to keep in captivity — it is, apparently, a matter of most individuals not being able to adjust from a fruit-and-leaf diet in the wild to the more restricted diet in the zoo. Nevertheless, the New York Zoological Park did quite well with a Mantled Howler Monkey from Ecuador (*Alouatta palliata aequatorialis*) which was received on July 20, 1950, and lived until May 18, 1954. It had, however, been captured as a very small baby and had been hand-reared and “fussed over” as far as diet was concerned.

The great naturalists of South America — Humboldt, Rengger, Wallace, Darwin, Bates, Belt, Beebe, Barbour, Chapman and others — have all written interesting accounts of howling monkeys. W. H. Hudson introduced the howler to the literary world in his romance of the Venezuelan forest, “Green Mansions.” More than twenty years ago Dr. C. Ray Carpenter studied the howler’s individual and group behavior and in 1934 published, in *Comparative Psychology Monographs*, what is considered one of the great works on primate ecology.

But the howler’s popular fame rests on his magnificent voice, a voice which has few rivals in the animal world. The males greet the dawn with a tremendous vocalization which resounds for a remarkable distance. Many writers report hearing it two or three miles away, although it is doubtful if it carries more than a half to three-quarters of a mile through dense forest. The sound is produced by resonating air forced into an unusually large and hollow hyoid bone in the throat, and is out of all proportion to the size of the animal. It is deep, penetrating and fierce.

The howling we had heard on our first morning on Barro Colorado was a declaration of territorial rights. The males directly above us were accompanied by females and juveniles. They were a family group, which may have been composed of any number from four to thirty-five individuals. They moved together, fed together,

This is “Ugly,” a Mantled Howler Monkey from Ecuador, which came to the Bronx Zoo as an infant and readily adjusted to a diet much different from its leafy food in the wild.



lodged together and ranged over a definite territory. There were many other similar family groups, or clans, of howlers on the island, and the distant answers we had heard came from the males of other clans. Each clan proclaimed its position and its territory.

The size of a clan's territory varied with many things; the number of males in the clan, the availability of food, the number and the pressure of neighboring groups. On Barro Colorado, an island of six square miles, there were approximately twenty-eight clans, each occupying an area a fourth to half a mile in diameter. The territories overlapped somewhat, for while a clan was on one side of its territory, a neighboring clan might make inroads on the opposite side. But when two clans approached each other closely, as in nearby trees, a deafening howling battle would take place, and the males would roar viciously at their opponents for an hour or more. Direct combat rarely occurred, for such vocal battles apparently provided a satisfactory substitute, and the rival clans would retreat into their own territories.

The typical day of a howling monkey clan began with the morning howling, followed by two or three hours of resting in the lodge trees

where the group had spent the night. The lodge trees were any large trees which provided a labyrinth of branches for the monkeys to recline on. Certain trees, such as the fig, almendro, carquera, sandbox or cedro espinosa were definitely favored, and there seemed to be preferences for trees with scant foliage. Partially or totally denuded trees were always present in the jungle, since many tropical trees seem to follow individual patterns of losing and regaining their leaves.

The monkeys would begin to move at any time in the morning. First one or two individuals would move into neighboring trees and others would follow. The progression was usually in single file, led by an adult of either sex. Normally the progression would be 200 to 400 yards toward some food tree of choice. A ripe fig tree represented a point of considerable attraction, not only for monkeys, but for parrots, coatis and even deer and peccaries, who would feed on the dropping figs. Usually, however, the howlers occupied a tree by themselves, and were rarely bothered by other animals. The more mobile White-faced Sapajou often sped through the trees near howler clans, but usually at lower levels, so that the two monkeys had little contact. The howlers fed on the fruits, leaves and stems of

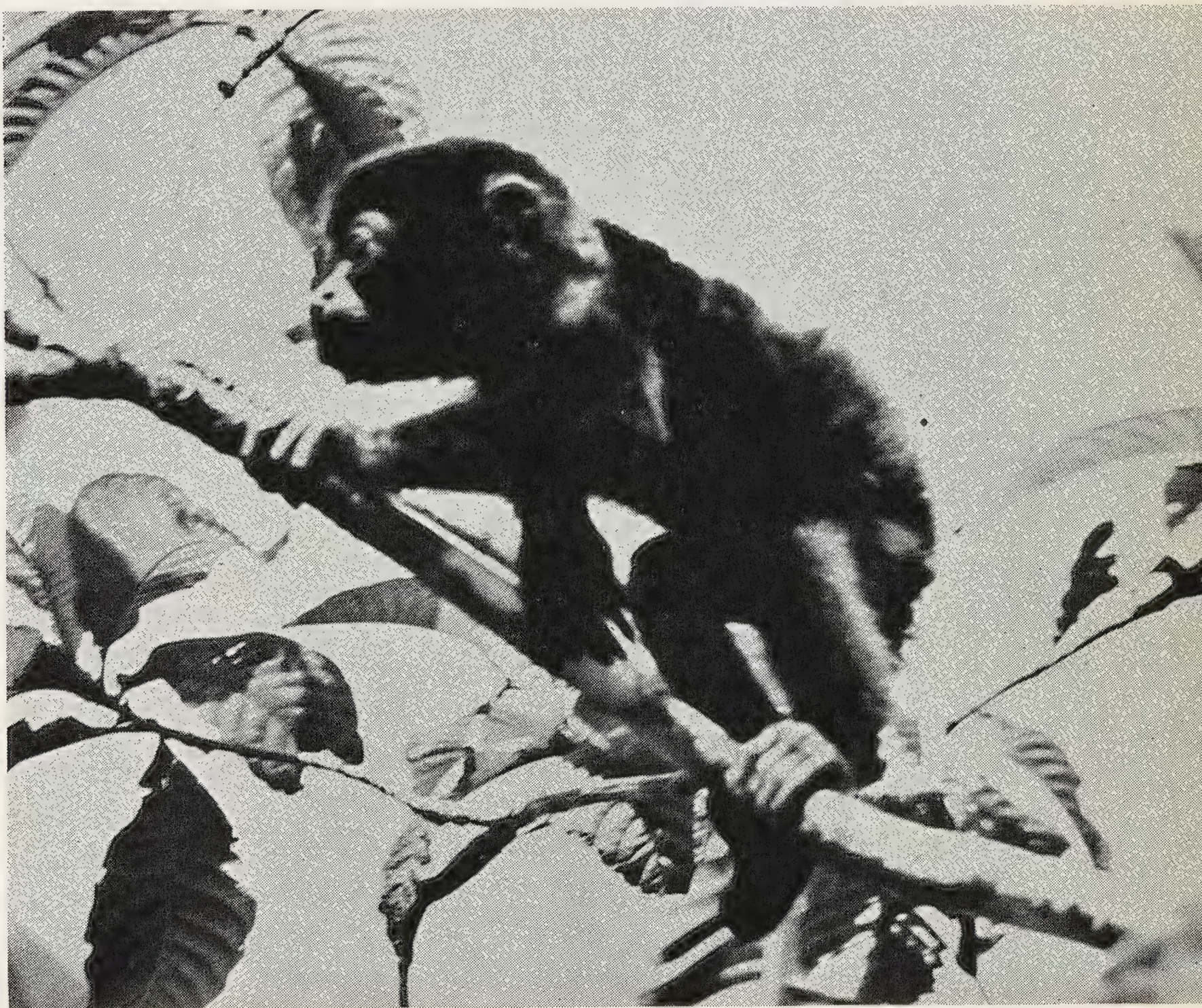
food trees, while the sapajous preferred only the fruits — another difference between the species which minimized competition. The leaves of the camito, espave, almendro, berbe, mangabe, carquera and wild nutmeg were also choice foods for the howler. They were apparently surrounded by an inexhaustible store of excellent foods, except in the driest of years when leaves might turn brown by the end of the dry season in March and April.

After an hour or two of feeding, the monkeys would generally settle themselves into position for a mid-day rest of several hours. While the

Sometime in mid- or late afternoon, the howlers would begin a slow progression out of their food trees toward the evening's lodge trees. This single file progression would again be one of several hundred yards. In passing from tree to tree each monkey usually went over the same branches and made the same bridge between trees, day after day. If the bridge was a precarious one requiring a stretch of several feet, one of the adults might form a bridge with its body to enable a juvenile to cross. Howlers are cautious climbers and almost always maintained contact with at least one hand, one foot, or the

An infant howler has just completed a difficult crossing by using its mother's tail and body as a bridge. Howlers generally use the same branches and make the same bridges in travelling.

(Photograph by C. R. Carpenter)



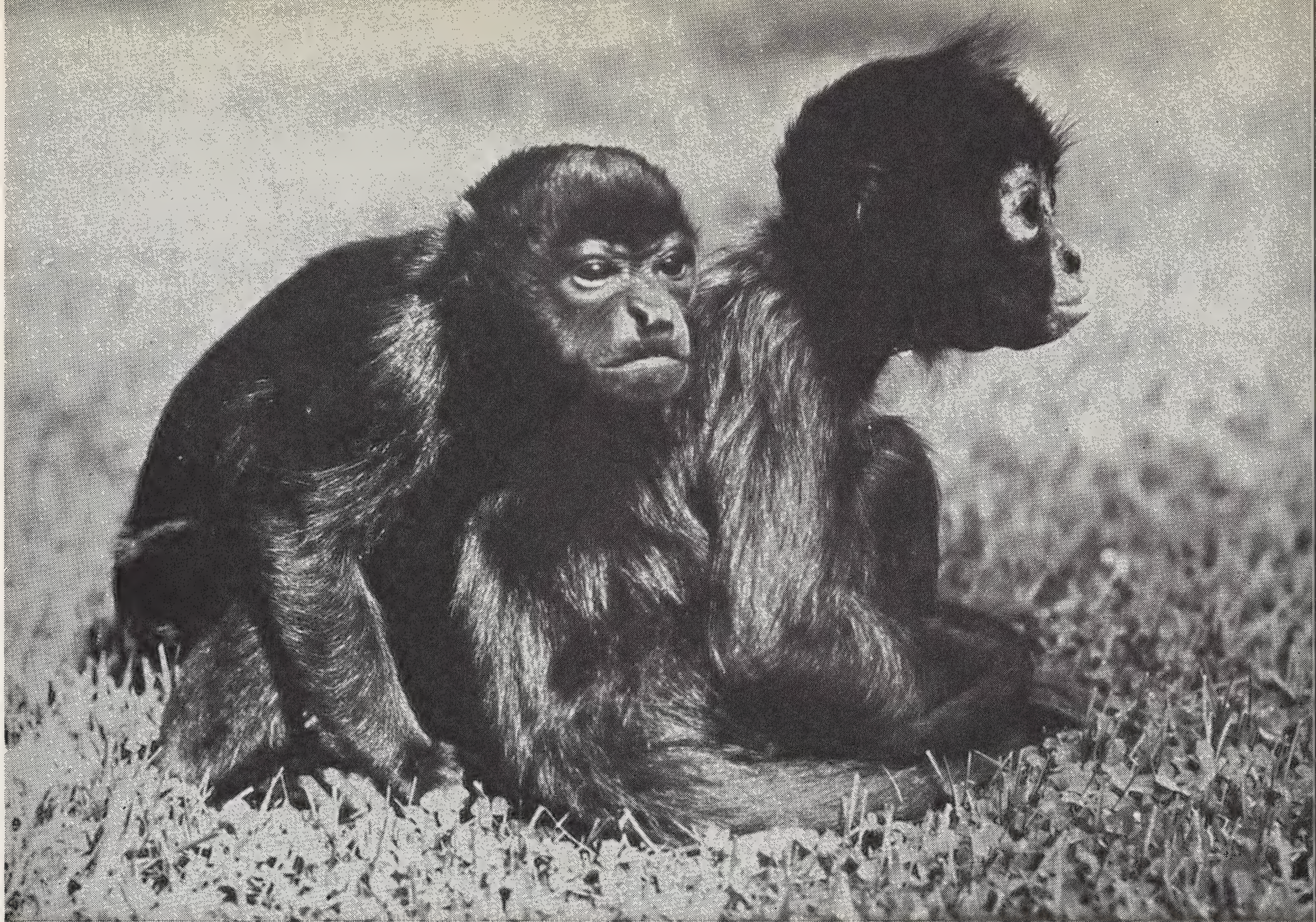
This little howler fell out of a tree and was attacked by the male of the clan. Such attacks by adult males on infant males may explain why comparatively few young males were found.

(Photograph by the author)

adults dozed, the infants or juveniles often played and provided most amusing shows. Two one-year old infants might stray a few feet from their resting mothers and engage in tag. They would clamber among the branches as a small boy climbs among monkey bars during a mid-morning school recess. Or they would dangle by their indispensable tails and have a good game of fisticuffs. If they were unaware of an observer, their play was spontaneous and delightful to watch. It might continue for an hour or two, the youngsters seeming never to tire of their simple games and explorations.

tail. This was quite in contrast with the fast moving White-faced Sapajous or Capuchin Monkeys, which would hurl themselves recklessly twenty or thirty feet into space when jumping from one tree to another or crossing a ravine. The sapajous were complete masters of their medium, whereas the howlers generally moved with considerable deliberation as if not quite trusting the trees in which their lives were passed.

By 6:00 or 6:30 o'clock, as the sun was setting, the howlers would be located in their lodge trees. They moved out along the branches and each found a spot of preference to spend the night.



They usually lodged high in the tallest trees and were sixty to a hundred feet above the ground.

When Dr. Carpenter studied the howlers on Barro Colorado in the early 1930s, he found the average clan to be composed of seventeen individuals, with wide variation, of course. The typical group had three adult males, seven adult females, four independent juveniles and three infants dependent upon their mothers. The young howler requires nearly three years to mature. In the first month after birth, the infant is only seven or eight inches long, excluding the tail, and his fur is light gray. He clings closely to his mother's abdomen and breast and never leaves this sheltered spot, even while she moves and feeds. By the time he is two to eight months old, he often rides on his mother's back. He is larger now, and has assumed a brownish-black color. At about one year of age, the infant still remains in close contact with the mother and rides on her back during a group progression, but in the mid-day siesta periods he may wander a few feet from her, exploring the nearby branches and beginning elementary games of play with other infants of his own age. Throughout his second year he becomes more independent, playing more vigor-

The sneering youngster on the left is a year-old male howler reared in captivity with a Red Spider Monkey of the same age. Spider Monkeys live in Panama but not Barro Colorado.

(Photograph by C. R. Carpenter)

ously, wandering further from his mother, and trying out the palatability of leaves and fruits for himself. When the group moves, however, he sometimes clings to the back of his mother. In the young howler's third year, he becomes an independent individual within the group. Moving, feeding and lodging by himself, he is no longer dependent upon his mother. He is nearly the size of an adult female, but a sufficient difference exists to distinguish him as a subadult. At the end of the third year and beginning of the fourth, the juvenile attains sexual maturity and develops a white, visible scrotum if a male, or becomes capable of bearing young if a female.

One wonders what happens to the young males to produce the marked abundance of adult females over adult males. Carpenter saw a male with fresh wounds and observed conflict between other adult males. Elias Uriola, an experienced hunter and one of our field guides, told us that adult males may attack and kill young males.

Dr. Collias and I obtained no direct evidence of this, but it is probable that some behavioral trait alters the adult sex ratio.

In 1933, Carpenter found 489 howling monkeys on Barro Colorado and they were grouped into twenty-eight clans. In 1951, we found only 237 howlers on the island. Our efforts at finding and studying the monkeys were made possible by the keen naturalist's ability of Sylvestri Aviles, who had been Carpenter's guide. Although the number of monkeys present in 1951 was less than one-half the number of 1933, the number of clans was about the same. We located twenty-nine clans, many of them occupying the same territory that they did twenty years earlier. The average clan size was now much smaller, however, being composed on the average of only one adult male, four adult females, one juvenile and one infant. If the average monkey lives nine or ten years, it is clear that the integrity of a clan is passed on for several generations and the same territorial area is traditionally maintained.

It is of great interest to biologists to discover what controls a natural, undisturbed population of animals living on an island. Does not reproduction increase population size beyond tolerable limits in such a confined population?

In the howling monkey, an obvious trait influencing population size is the intolerance between clans, although its actual mechanism is somewhat obscure. Each clan maintained an area of its own, and other clans approaching too close were strongly repulsed. Such a characteristic of intergroup intolerance might force certain clans into submarginal habitat where existence would be precarious. The howler is much like the Bob-white Quail — a strong cohesion within the clan or covey maintains the group, but intolerance between groups limits the number of animals on an area and prevents over-exploitation of the sources of living. The howler and the Bob-white prefer to live with elbow room.

Such intergroup intolerance might help to explain the presence of the same number of groups now as compared with twenty years ago, but it could not explain the reduction in group size by nearly one-half. Such a phenomenon as reproductive failure, predation or disease might seem the more likely cause of a reduction in clan size.

In the Barro Colorado population, casual evi-

dence suggested that the reduction in numbers had been of recent and rather sudden occurrence. This indicated a mortality factor rather than a change in reproductive rates.

None of the students of howling monkeys has found evidence of extensive predation. The howlers are largely unharried by predators on a sanctuary such as Barro Colorado. On the mainland of Panama they are hunted by natives, but hunting was prohibited on the island. Other natural predators such as Cougars and Tayras are present on the island, but no evidence indicates that they can capture a howler except on rare occasions. In one instance, an Ocelot has been known to capture a young monkey. Harpy Eagles are present in Panama but are of little significance in the life of the howler. By and large the howler is king of his habitat, and suffers no depredation at the hands of a vertebrate predator.

Disease and parasitism, however, represent more probable mortality factors. Occasionally an individual showed obvious signs of sickness, with slow and sluggish movements, poor appetite and failure to exhibit normal reactions to other monkeys. Howlers are frequently parasitized by botfly larvae which produce swellings about the head, neck and chest. Pathological studies on howlers collected in various areas of Panama have shown parasitic infestation of the liver, and grossly enlarged spleens with deep scars, indicative of infectious disease.

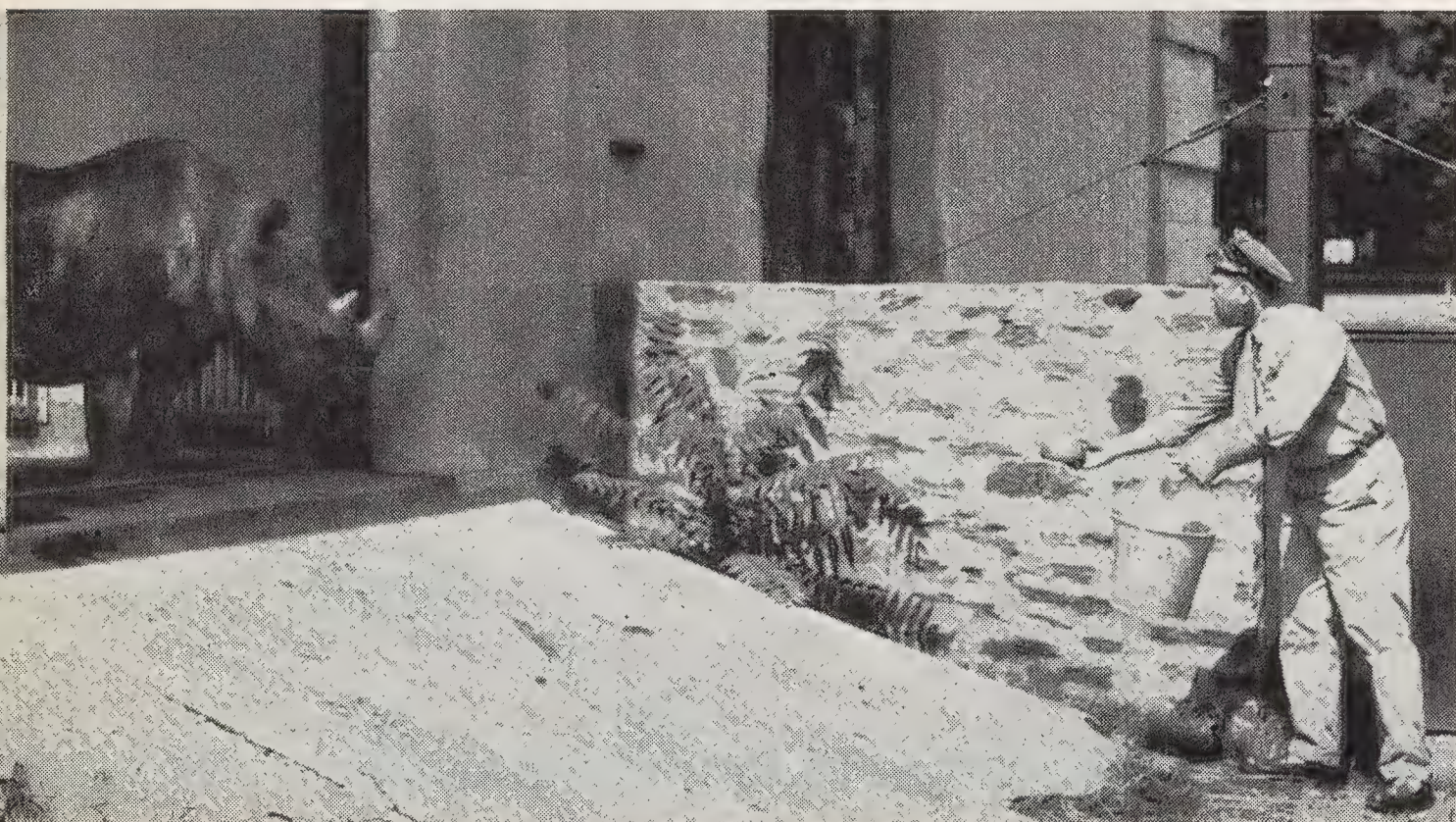
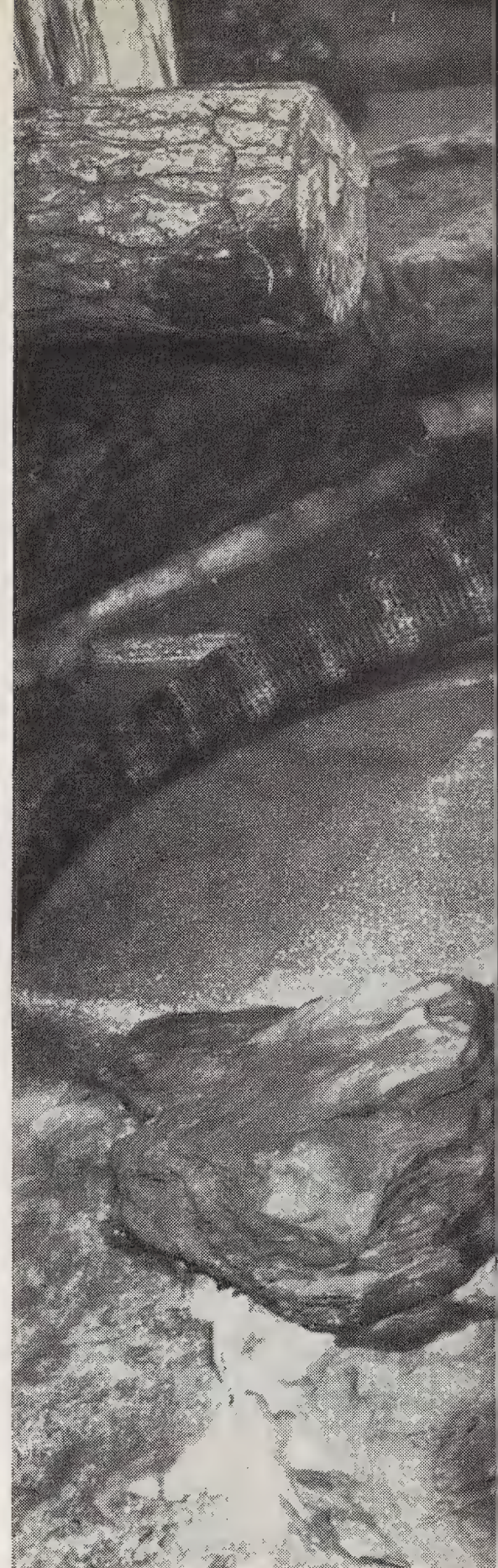
Many studies have centered around the relationships of yellow fever to various species of monkeys. Several investigators have found evidence suggesting that epidemics of jungle yellow fever have occurred among monkey populations in Brazil, killing large numbers of howlers. Thus, there are many indications that natural populations of howling monkeys are decimated by disease.

One cannot visit a tropical research station like Barro Colorado without feeling gratitude toward those who foster and protect such magnificent areas throughout the world. Barro Colorado lies in Gatun lake, and the entire commerce of the Panama Canal passes within 200 yards of its shores. Yet, despite this proximity to world trade, the island remains a gem of tropical America, and the Black Howling Monkey rules as a magnificent member of its fauna.

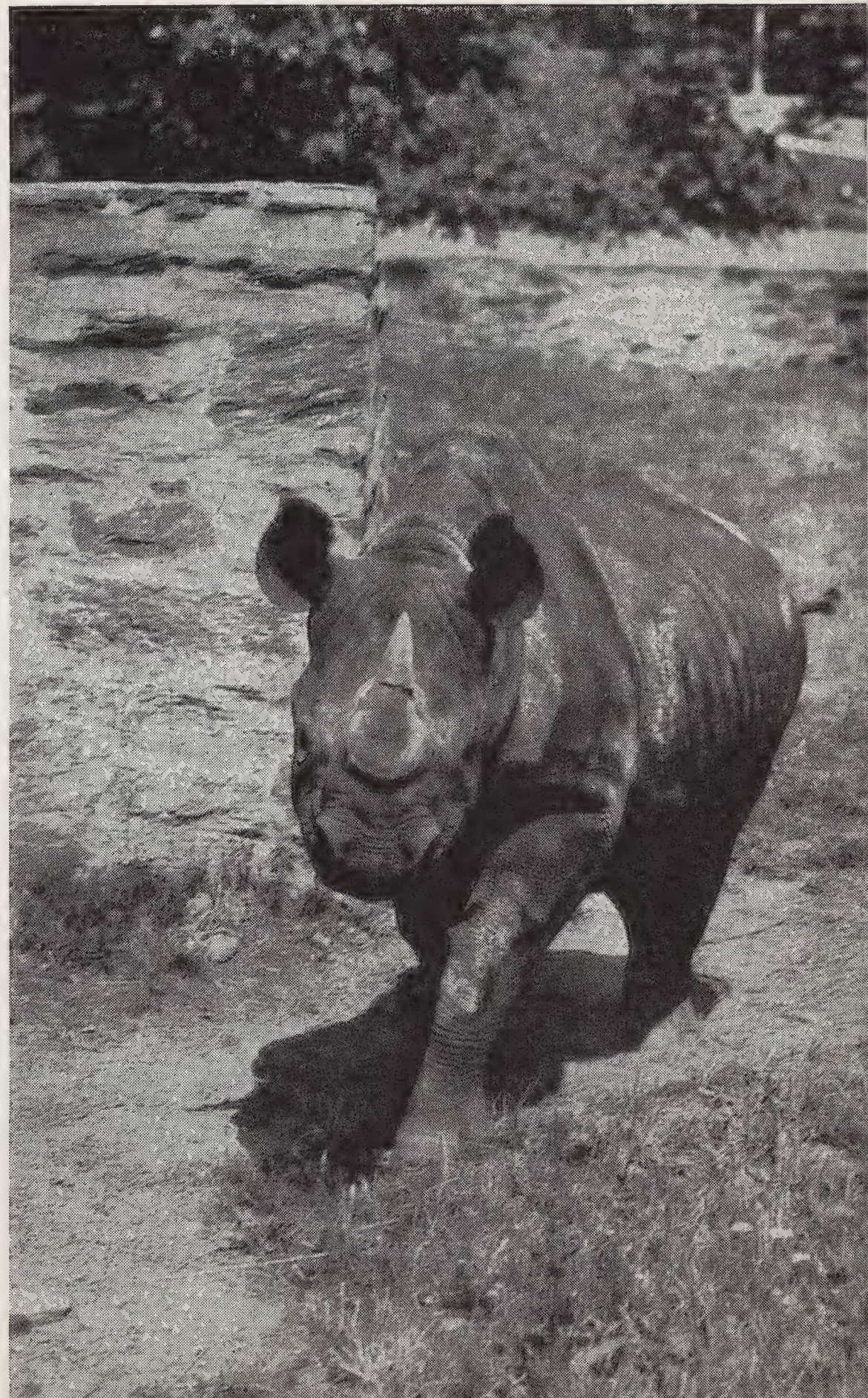
MID-SUMMER IN THE ZOO

Photographs by SAM DUNTON

KOMODO MONITORS, or "**DRAGON**" **LIZARDS** are not prehistoric monsters unaccountably surviving in a remote part of the world (as some of our visitors have been heard explaining to their children), but, simply, the largest of present-day lizards. Our two specimens of *Varanus komodoensis* arrived on May 22 by air, only five days after they left the Surabaya Zoo in Java, where they had been kept for four years. They are a pair; the male weighed 218 pounds on arrival and is 8 feet 9 inches long; the female weighed 109 pounds and is 8 feet 4 inches in length. A little more than 10 feet seems to be maximum length for the species, which is found only on four small islands (including Komodo) in Indonesia. For the first few days our monitors were lethargic and sleepy — not unlike human beings after a similar tiresome journey. They are now so active that when a keeper enters their compartment for any purpose, another has to fend off the male with a wooden shield. Our best information was that adult monitors could not, or did not, climb. Consequently no steps were taken to screen the concrete flower box along the wall at the rear of their compartment in the Reptile House. To our dismay, the male reared slightly on his hind legs, hooked his front claws over the lip of the box (46 inches above the floor) and hoisted himself into the plants. Fearing he might injure himself when he half-slid, half-fell to the floor, we have boarded up the ledge. At first, the monitors readily took strips of horsemeat, but later refused it. Well-ripened pork is now their favorite food, although they also accept squabs (but not pigeons) and hen's eggs. They are entirely carnivorous, and are certainly deliberate feeders, sniffing their food, circling it, going away and coming back between each chunk of meat they swallow.



A "timid rhinoceros" is virtually a contradiction in terms. It nevertheless describes Little Joe, the new **AFRICAN BLACK RHINOCEROS** we received on June 10 from Tanganyika by way of Germany. Although he had been in the German station for about a year and was well accustomed to people, sudden noises — even the voice of one keeper calling to another — startled him and invariably his tail went up and he whirled to face the supposed danger. Little Joe (a youngster of about four years, weighing 1,240 pounds on arrival) stayed in his stall in the Elephant House for most of his first week with us, despite coaxing by his keeper and offers of food outside his door. In the end, he made up his own mind that the outside world was not dangerous, and ventured out. Now he comes and goes at will and is so well adjusted that he has learned to beg for popcorn over the stone wall.





Nine **KING COBRAS** hatched successfully from the thirty viable eggs deposited by our female cobra in her self-made nest on April 24. The first youngster was found outside the egg on the morning of July 4, and others struggled out between then and July 12. Some few eggs simply failed to hatch; in others the snakeling was deformed because of a deficiency of temperature or humidity during incubation — for Curator James A. Oliver had to guess at the optimum conditions for incubation. We are, actually, quite content that the entire “setting” of eggs did not hatch, for the Kings feed on other snakes and it is impossible for us to supply

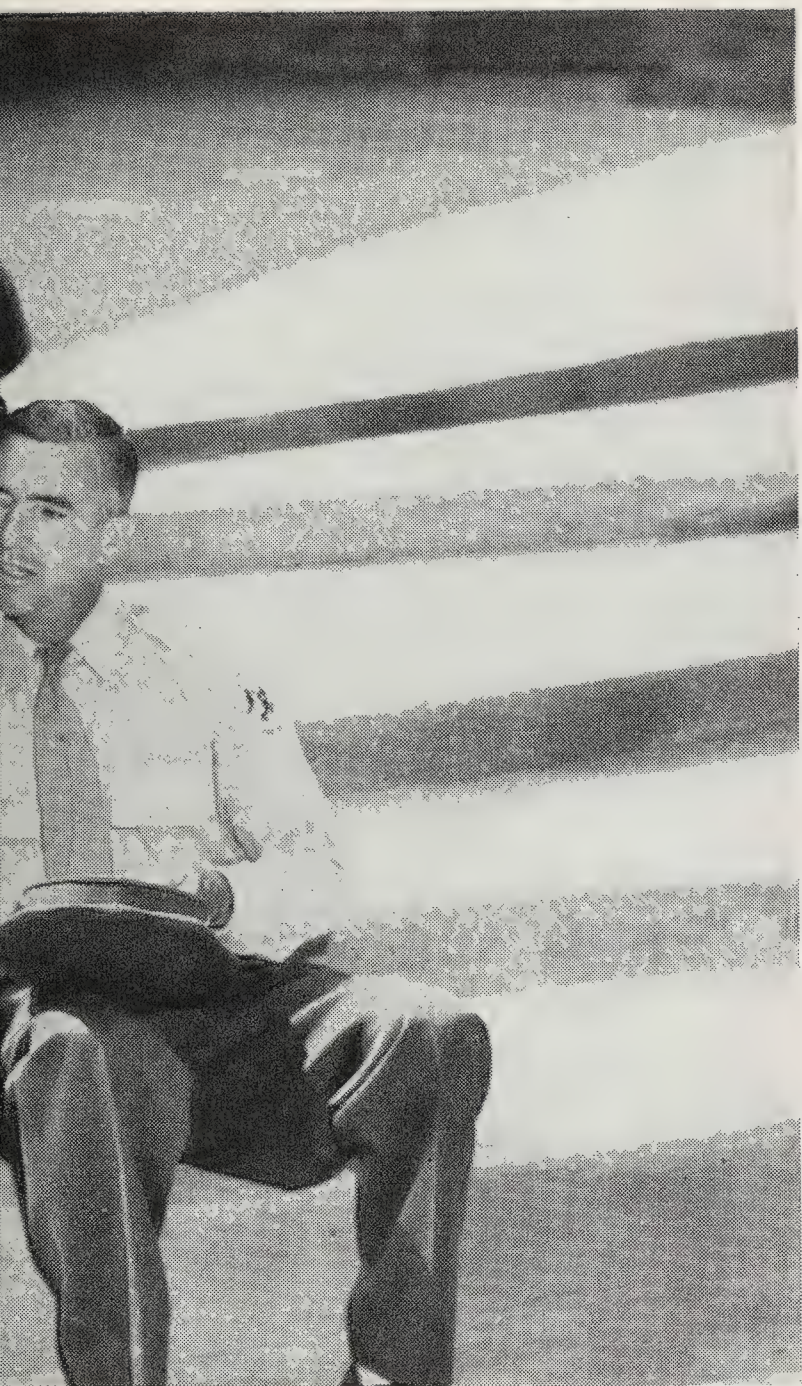
enough young or small snakes to maintain a large number of baby cobras. Up to the end of July the juveniles were sufficiently nourished by the yolk of the eggs from which they emerged, but Dr. Oliver is hoping to induce them to accept dead mice impregnated with snake odor by rubbing with live snakes. The little cobras are strongly marked with white bands on their black bodies, but in a few years these should give way to the uniform olive drab color of the adults. They are fully equipped with venom apparatus on hatching, and several of them — as here — spread their hoods and struck at the photographer while still emerging.





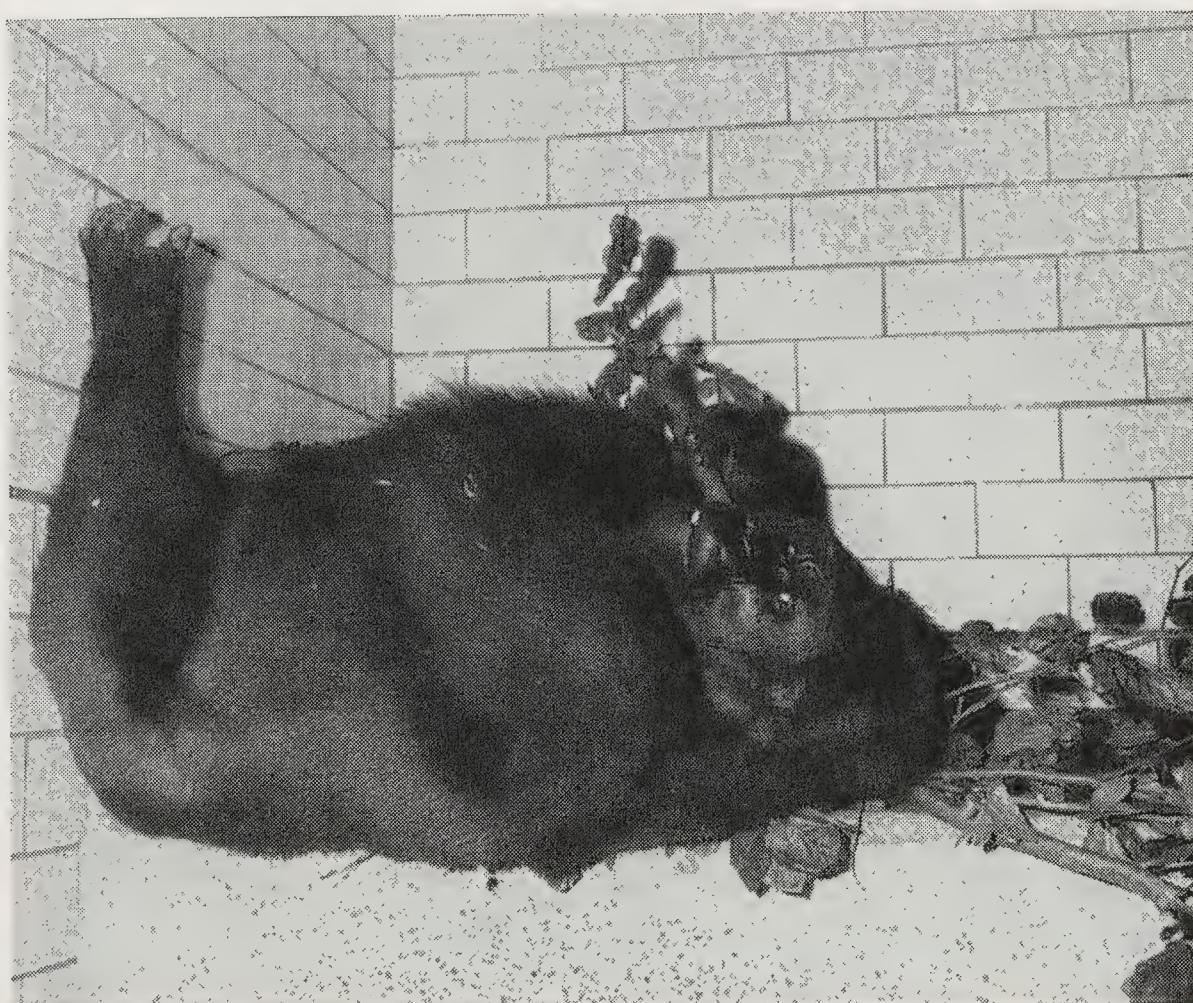
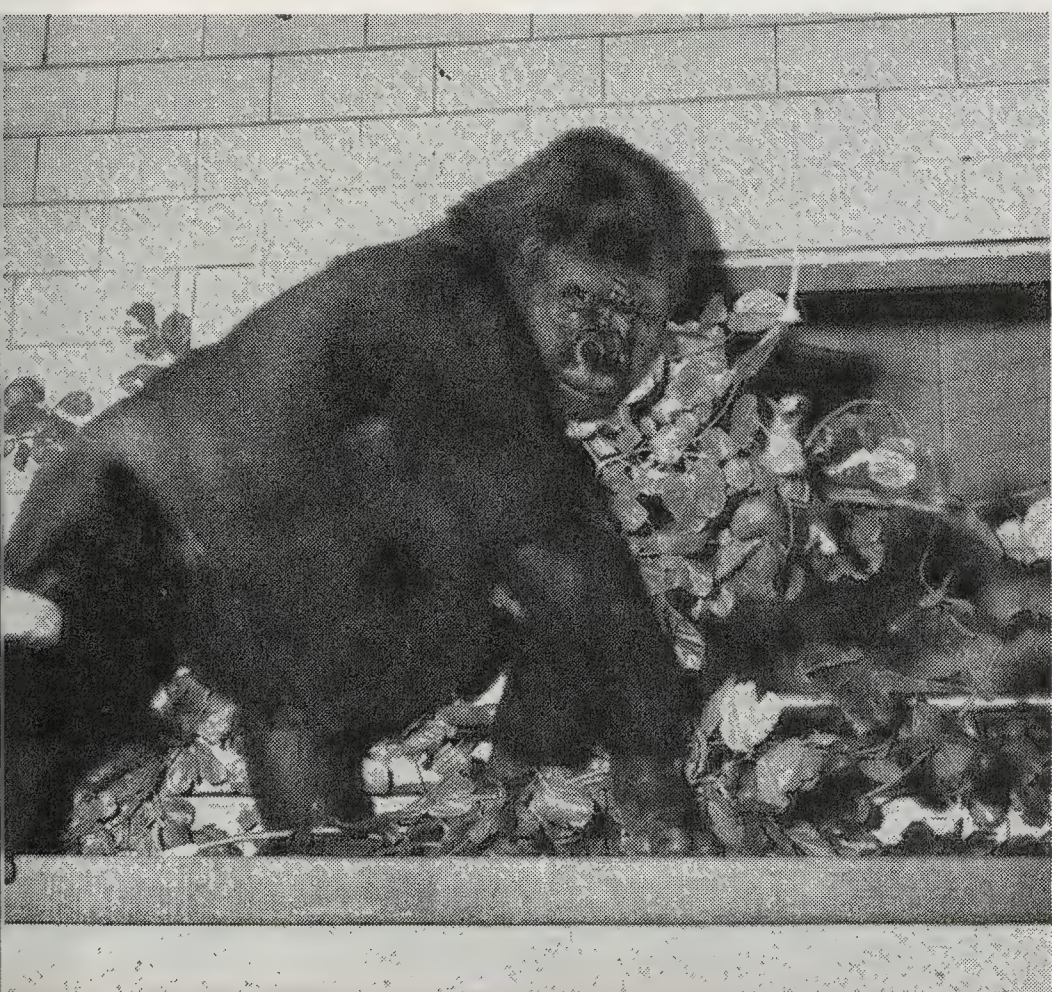
OKA, our female **LOWLAND GORILLA**, Apes House, have known each other a good while. Mickey was a timid baby about a year and a half before he was brought to the zoo from the Congo in the fall of 1941. By the time he was three years old, he was under the part-time care of Keeper Quinn. Mickey has been Mickey's special pet and care in the last few years. He was brought to the zoo in the fall of 1950. They have complete confidence in each other. It means that Mickey has never failed to have Mickey in her hand when he passes; at the very least, Mickey has never failed to have a handshake. On Mickey's side, the confidence and Keeper Jim Reilley have played simple games. Mickey has never really struggling for physical mastery. For example, it became necessary to recapture Mickey when the keepers were cleaning her compartment. Mickey was very cooperative in these circumstances, as every good animal man can tell you. These photographs





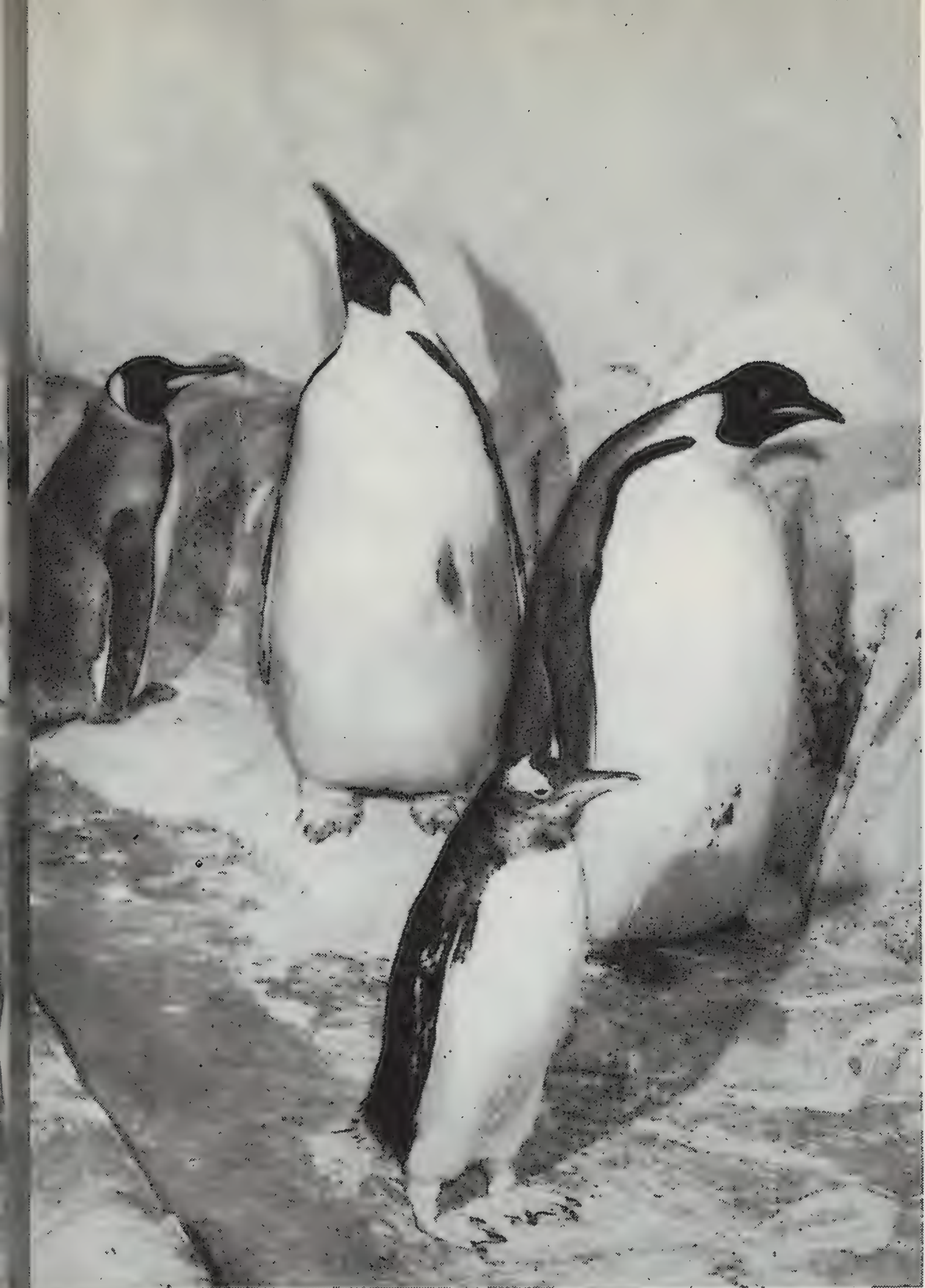
MICKEY QUINN of the Great Apes House. "Doll," as Mickey calls her, came to us from French Equatorial Africa. Three years old she had come to the Great Apes House and she has been with us ever since. On Oka's side, it is a matter of life and death (a bit of candy) to drop her for a conversation and she is vital. Since her babyhood he has never pushing her too far, but outwitting her when, for the night he might have stolen while they were probably behavior under most result he and Oka have a great afternoon in July when Oka

seemed in the need of amusement. The Park's tree pruners had just brought in a truck load of branches and Mickey abstracted a few. It is part of the game for him to dole them out to Oka grudgingly — to hang on and pretend to tug until Oka wrenches them out of his hands. The afternoon was particularly hot and humid and Oka was restless in the sun, wanting to go back into the comparative coolness of her compartment inside the building, but when the branches appeared she stood her ground until the last one had been yielded to her. Then she dragged and carried her treasures to the bottom of the moat where an open pipe spills a stream of water into the enclosure. By splashing and an inefficient kind of dunking, she managed to wet most of the leaves, and then she hastily dragged them through the open door into the building and onto the ledge where she customarily sleeps. As the last photograph reveals, at the lower right, she made herself a comfortable bed and relaxed. Whether the continuing friendly relationship between gorilla and keeper would have been so strong if Makoko, Oka's male companion from babyhood, had not died in 1951, is perhaps doubtful. Maturing with one of her own kind, it is possible that Oka would have had less need for human companionship. As it is, she and Keeper Quinn have a lot of fun, for Oka is always ready for gentle play.



There are comparatively few animals whose main appeal to visitors to the Zoo is the sheer preposterousness of their appearance; the **GIANT ANTEATER** is one. Perhaps the chief one. If the startling effect needs to be heightened, one has only to come on a Giant Anteater asleep — a formless mound of coarse hair dropped carelessly in the corner — and then wait until the hair is whisked away and becomes a tail, the whole unbelievable animal uncurls and stands up to stretch and delicately yawn. For perfection, wait until the anteater whips out its tongue (see picture on page 100).





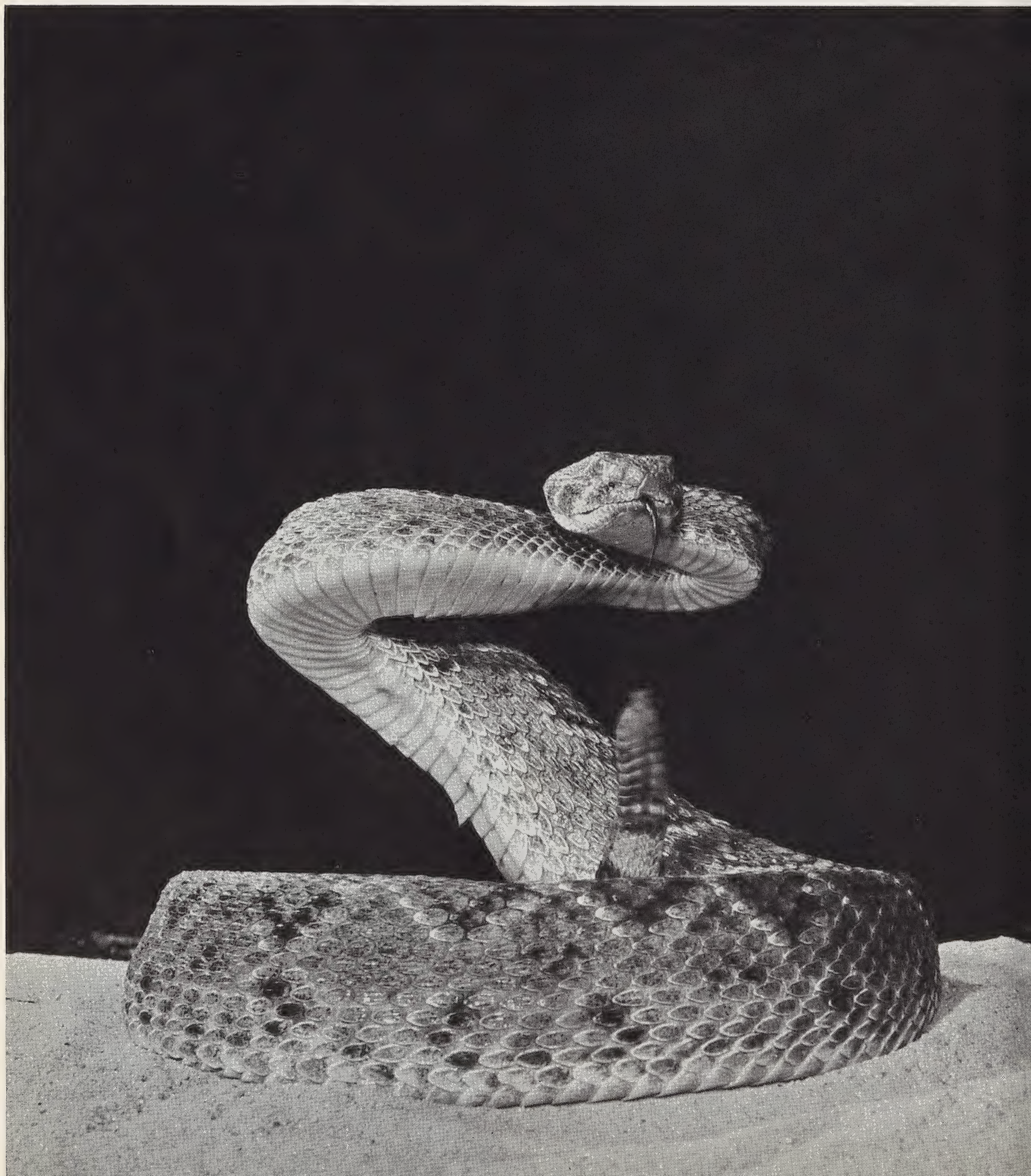
Seldom happens that two events of major interest and importance are captured in a single photograph, but that is what has happened here. This scene in the Penguin House shows not only **EMPEROR PENGUINS**, the first ever exhibited in our collection, but a **KING PENGUIN** incubating an egg — again, the first in our history. The two massive Emperors in the foreground (flanked by a little Gentoo Penguin) came to us on April 29 through the courtesy of Director William Mann of the National Zoological Park and the Secretary of the Navy. Until laboratory tests revealed that they were free of the invariably fatal aspergillosis infection, our Emperors were kept in strict seclusion in the "Penguin Cooler" in the annex to our Aquatic Bird House. On July 10 they were declared healthy — but in the meantime, one of our four King Penguins had laid an egg, on June 24, and was incubating on the rock ledge in the Penguin House. (It is the single bird on the left of this photograph, standing with its back to the camera; it holds the egg on its feet, covered by a fold of belly skin). Although we were now at liberty to put the Emperors on exhibit in the Penguin House, we hesitated to do so for fear of disturbing the incubating King. At that moment fate intervened. During the hot spell of mid-July, the motor of the Penguin Cooler's air-conditioning apparatus burned out on a Saturday afternoon, no replacement could be found, and Headkeeper of Birds George Scott had to take matters into his own hands and put the Emperors in the cool Penguin House, egg or no egg. And it worked out perfectly well — Kings and Emperors were indifferent to each other. The King egg should hatch about August 15; incubation varies between 50 and 55 days. So far the same bird — unknown — has held the egg, and the keeper feeds it daily.



The attendants' work in our Animal Hospital is often long and hard, but there are compensations: for example, playing with a baby **CONGO POTTO**. Otto the Potto was reared by Nurse Mary Murphy after we learned from previous births that its own parents could not or would not rear it. As Otto gained in size and strength, Attendant Waltz devised an exercise apparatus — a length of rubber hose which he reversed once Otto had climbed almost to the top — an endless game.

How We Photographed

A Rattlesnake's Strike



By HENRY M. LESTER

*Photographic Consultant of the
New York Zoological Society*

EARLY IN AUGUST of last year the Staff Photographer of the New York Zoological Society telephoned me and calmly laid a problem in my lap. Sam Dunton is an old friend and his technical photographic problems are always interesting. *How* interesting, absorbing, difficult and at times heartbreaking neither of us realized at the moment.

For the past two years, Sam said, the Zoological Society had been making motion picture films of an educational nature, in a series devoted to the living reptiles. The latest of these was to deal with the defensive behavior of reptiles, and what the Staff Photographer was asking for was my help in producing ultra-slow motion views of a rattlesnake's strike, preferably in color. Some years ago I had photographed in the Zoological Park the flight of a hummingbird, slowing down to a lazy flapping its 80 wing beats a second. Elsewhere I had made slow motion pictures of the flight of a drone fly performing its feats at about 250 wing beats a second. To show in great detail in slow motion the swift strike of a rattlesnake would be, Sam suggested, an appropriate next step forward. And . . . so it was!

At the time, about all I knew about the strike of a rattlesnake was what I had read in the excellent article Walker Van Riper of the Denver Museum of Natural History had published in *ANIMAL KINGDOM* earlier in the year ("The Speed of a Rattlesnake's Strike," March-April, 1954). His fascinating report, based on observations, measurements and calculations, gave the total time of the strike as roughly one-quarter of a second. His high-speed photographs were clear

illustrations of this action and proved that a strike *could* be recorded — in still photographs, anyway.

High-speed motion picture photography of sudden events, such as a rattlesnake's strike, is considerably more difficult than high-speed still photography because the high-speed movie camera must gather speed before the slim ribbon of film is travelling past the camera's film gate at a rate of 40 to 50 miles an hour — which it does when it is taking pictures at the rate of 2,500 to 3,000 frames per second. Such a "running in" time, while the camera gears are picking up speed, requires from one-half to three-quarters of a second, and after that the camera runs for another three-quarters to one second. Altogether, the high-speed motion picture camera whips through a 100-foot roll of film in about $1\frac{3}{4}$ seconds. A conventional motion picture camera, were it to run without stopping, would take about four minutes to use up a 100-foot roll of film.

Another complication of such an assignment as Sam Dunton was proposing is that of illumination, of which the high-speed motion picture camera requires a great deal. Taking 2,400 pictures a second calls for an enormous amount of light because each individual picture is exposed for only $1/12,000$ th of a second. A lot of light usually means a lot of heat, and that is something that a snake could not endure for any length of time. Even if it could survive the light and heat, it would not be likely to be in a mood to strike.

For the illumination problem we had a ready-made solution. Probably not altogether to the liking of the snake, but well within its tolerance. I have for years used a Continuous Flash Lighting outfit which enabled me to get high-speed motion pictures of the hummingbird, the drone fly and other subjects. It consists essentially of two large reflectors, 18 inches in diameter, within which revolve 17 large photoflash lamps that fire consecutively. The two units, flashing

And this is "Herman," the tough and aggressive Western Diamondback Rattlesnake that proved to be the perfect subject for high-speed photography. Of all the 20-some-odd snakes tested, "Herman" alone was invariably willing to rear and strike.

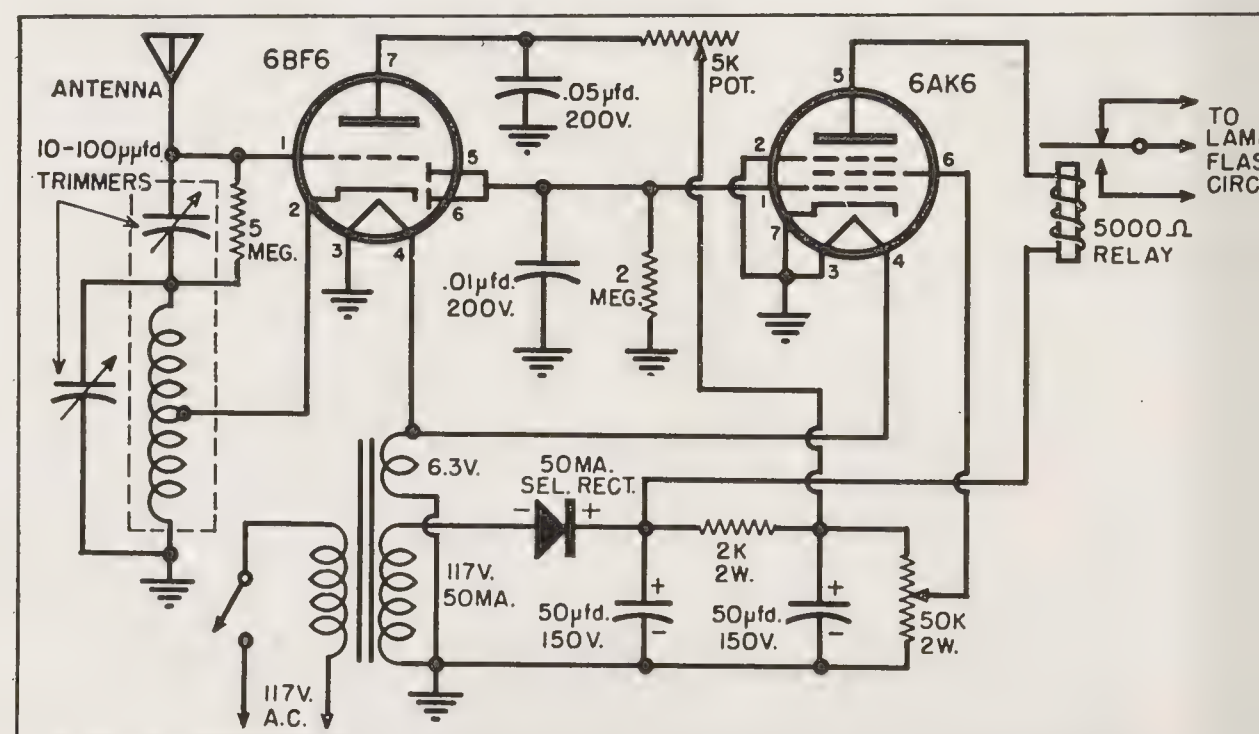
a total of 34 lamps, emit a total of some 3,000,000 lumens of light when their beams are superimposed on the subject. That is many times the light available to us in July and August sunlight. This literally stunning illumination lasts for only one second but, since the useful running time of the camera is only about one second after it reaches peak speed, when camera and lights are synchronized we can expose 65 to 70 feet of film with an abundance of light that would be difficult to get by any other means. To secure comparable illumination with conventional lighting sources would require roughly a thousand of the bright 100-watt household lamps, a powerhouseful of electric current, miles of cables, space-consuming reflectors and auxiliary paraphernalia. The Continuous Flash outfit has the further advantage that it does not radiate much heat on the subject, the heat being largely dissipated as the firing lamps revolve, and the lighting cycle being too brief to impart to the subject more than a passing sensation of warmth.

Ordinarily, synchronizing the flashing of lamps with the run of the camera is a simple procedure. The camera has an actuating mechanism which can be adjusted to start the firing at any point of the passage of film through its gate. But inducing the rattlesnake to strike at some moment during the critical one second when the camera was at full speed and the lights were on . . . there was the rub. The impossibility, we began to think, once we were into the problem. We might as well have been playing Zero on a roulette wheel. Actually, twenty-odd Diamondbacks were flown in from Texas at various times during the course of the experiments, always with the suppliers' promises that these particular specimens were *really* "hot." They may have been "hot" by Texas standards but in the Reptile House laboratory they were merely unpredictable; if they struck, it was either before or after the single second when we were ready to photograph them.

We formed a working team to pool all our skill and ingenuity. It included Dr. James A. Oliver, the Curator of Reptiles; Sam Dunton, the Staff Photographer; Stephen Spencook, the Head Keeper of Reptiles; William Bridges, the Curator of Publications; and myself. For weeks we planned, photographed, confessed failure,

schemed and photographed again. Targets for the snake to strike at came and went, and one of the most likely, as we thought, was no more effective than any other. Dr. Oliver offered his own legs as a target — in snake-bite-proof boots and trousers, of course — but all to no avail. Despite Dr. Oliver's assurance that snakes are deaf to air-borne sounds, I insisted on trying amplified audio oscillation, all the way from 20 to 20,000 cycles per second, and all of us had an enjoyable half-hour testing the acuteness of our own hearing. Toscanini is said to be able to hear tones up to 20,000 cycles a second. None of us was a Toscanini — and neither was the snake.

We even tried injecting some of the snakes with a hormone to make them feel that old



springtime aggressive urge. They *did* respond somewhat more actively, but not with the certainty that we needed.

And so, at a plenary session of the working team in November, it was decided to abandon the project, at least for the time being. We had run out of film and flashlamps and we felt that the snakes were tired of playing games. It seemed wise to lay the experiment aside until the spring of 1955.

Looking back, it seems probable that the late season did have something to do with our failures, for rattlesnakes are notoriously more aggressive and willing to strike in the breeding season in the spring. In any event, in March of this year Dr. Oliver received an offer of some guaranteed "hot" snakes from his supplier in Texas. The working team immediately held a conference and a suggestion made by Sam Dunton sent us into immediate action.

Since, Sam reasoned, it was the snake that

made the decision when to strike or not to strike, would it not be better to start the camera, let it reach a speed somewhat slower than 3,000 frames a second in order to extend the useful running time of the film to about $1\frac{1}{2}$ seconds, and let the snake — not the camera's tripping mechanism — actuate the flashlamp circuit?

The obvious advantage of such an arrangement would be that if the snake did not strike during the run of the camera, the lights would not flash — thereby saving us 34 flashlamps worth about \$10 — and the film would not be exposed in the prevailing working light, another \$10 economy.

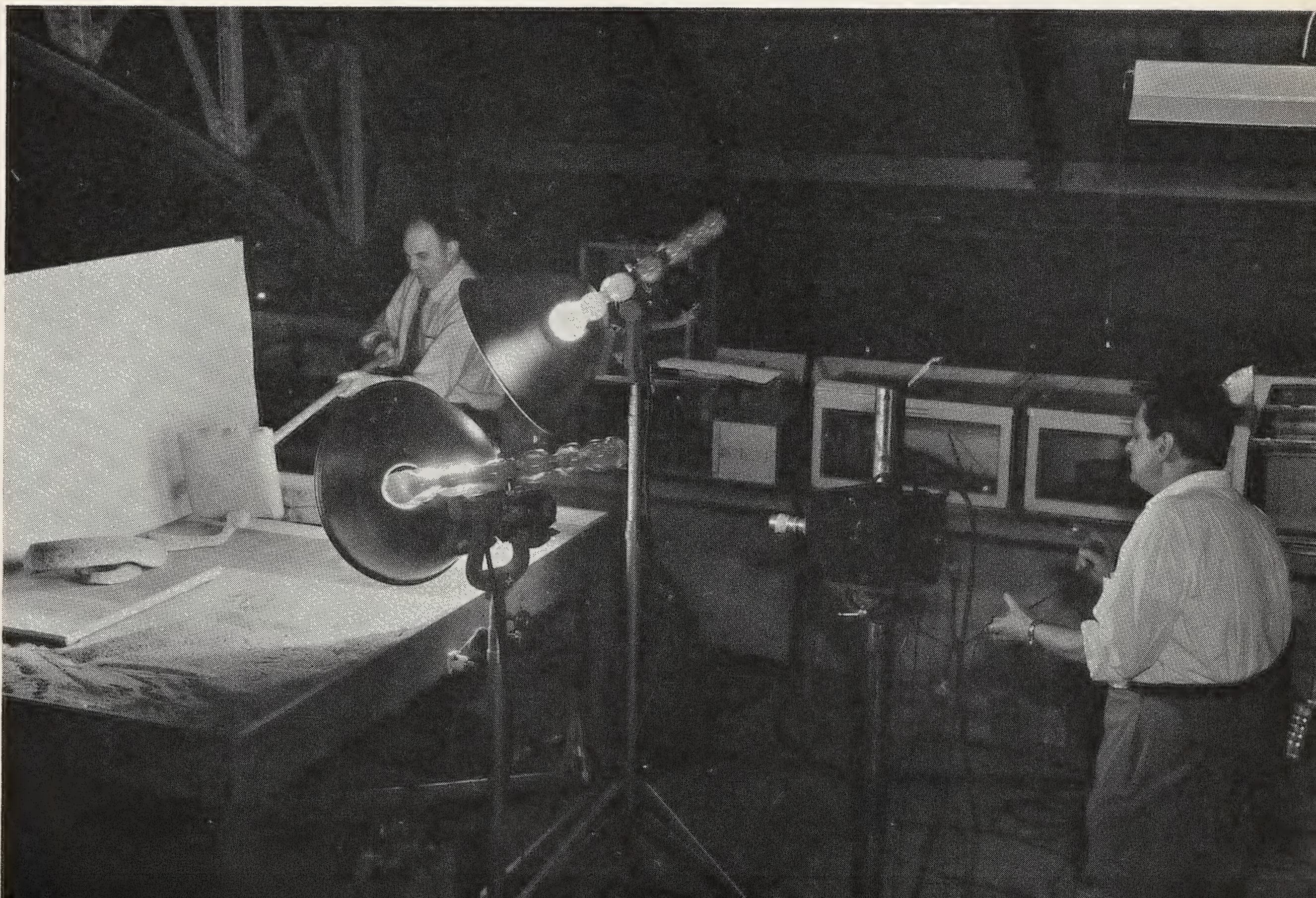
This seemed to be a capital idea. We immediately reassembled the photographic equip-

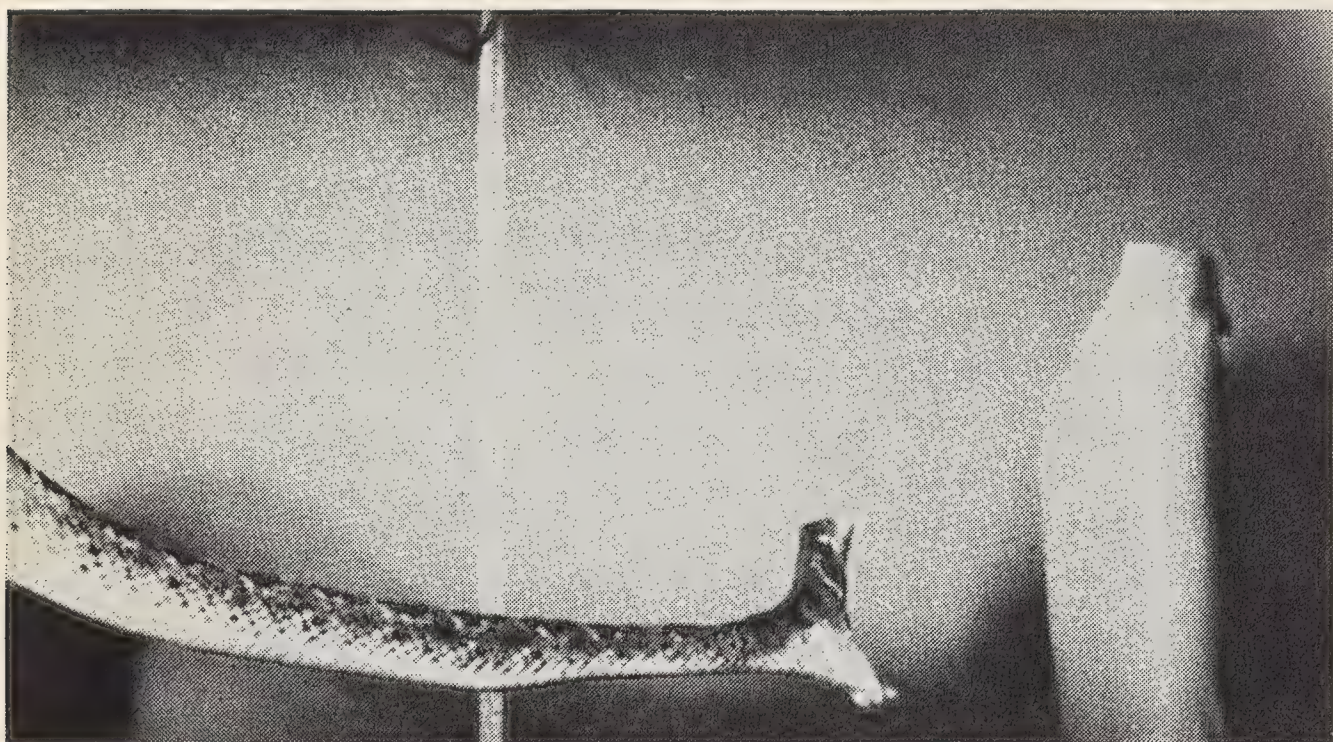
ment (about half a ton of it!) and set it up in the mezzanine laboratory of the Reptile House where, under ideal conditions, we had previously worked. Sam's scheme meant that additional equipment would have to be devised to put it into effect. At first we considered using the rather conventional "electric eye" beam of light — the device that is familiar to many of us as it opens the doors at the Pennsylvania Station — and to set it so that an interruption by the snake's body would actuate the flash circuit. That idea we abandoned when we realized that too often the hand-operated target would cut into the beam and set off the lights. Instead, we decided on what is called a sensitive capacitance relay. This is in fact nothing but a very tiny broadcasting transmitter (to put it in familiar terms) with a sharply delineated zone of sensitivity. The snake's head, upon entering this zone, causes an electrical disturbance which is instantly relayed to a fast-acting electric switch that closes the flashlamp circuit. A manual adjustment was built into this device so that the sensitivity could be individually adjusted for each snake in its pre-striking position.

Many trials and errors later we embarked on a new series of attempts with a working setup

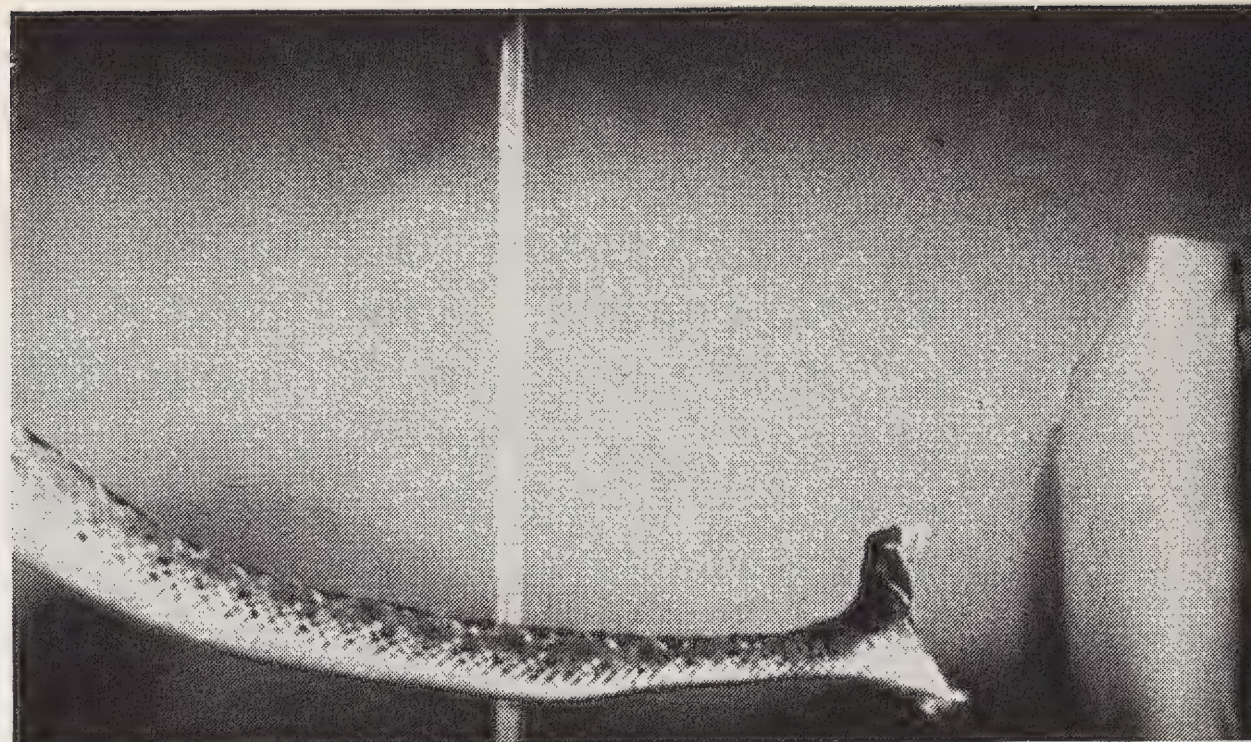
This electronic "brain" was finally devised by Mr. Lester to make the rattlesnake itself set off the flashlamps used in high-speed photography. It saved scores of flashlamps.

A strike. Dr. Oliver grimaces in the glare of the lights and at the right Mr. Lester operates controls of the camera, through which film is rolling at 40 miles an hour.

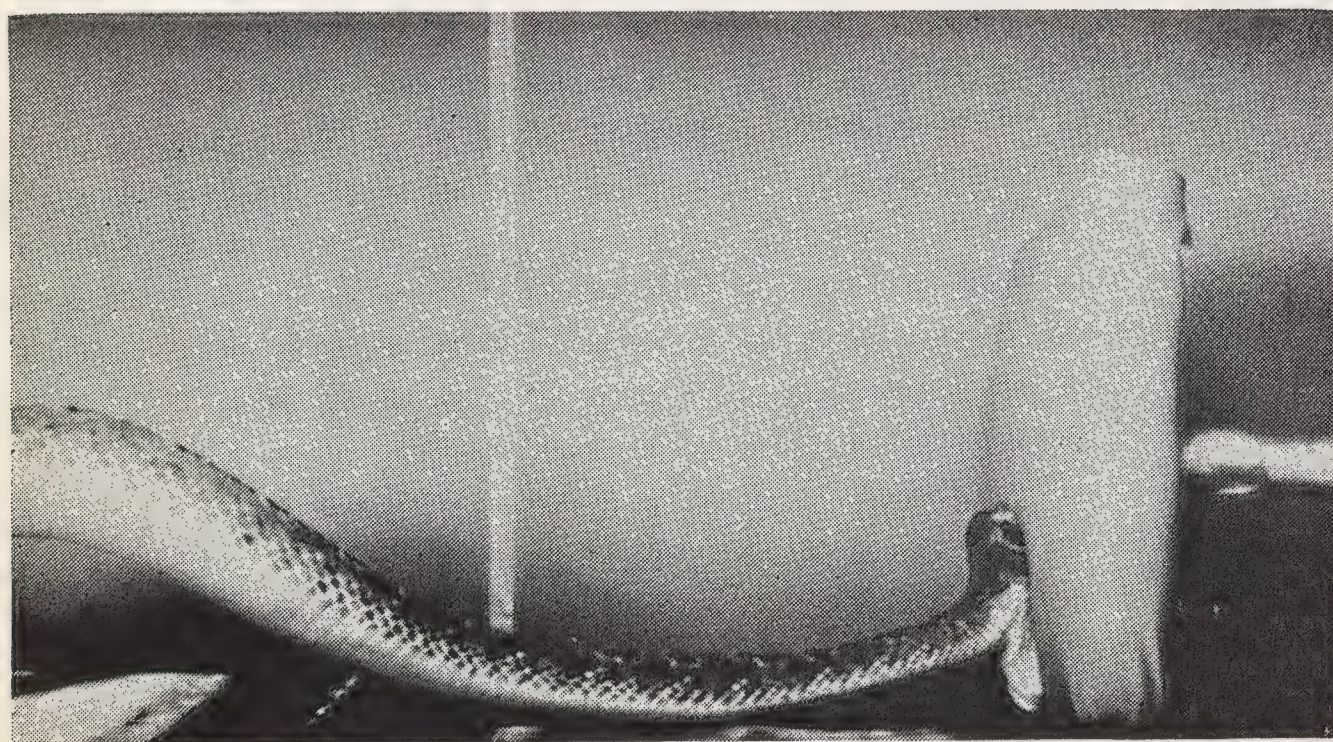




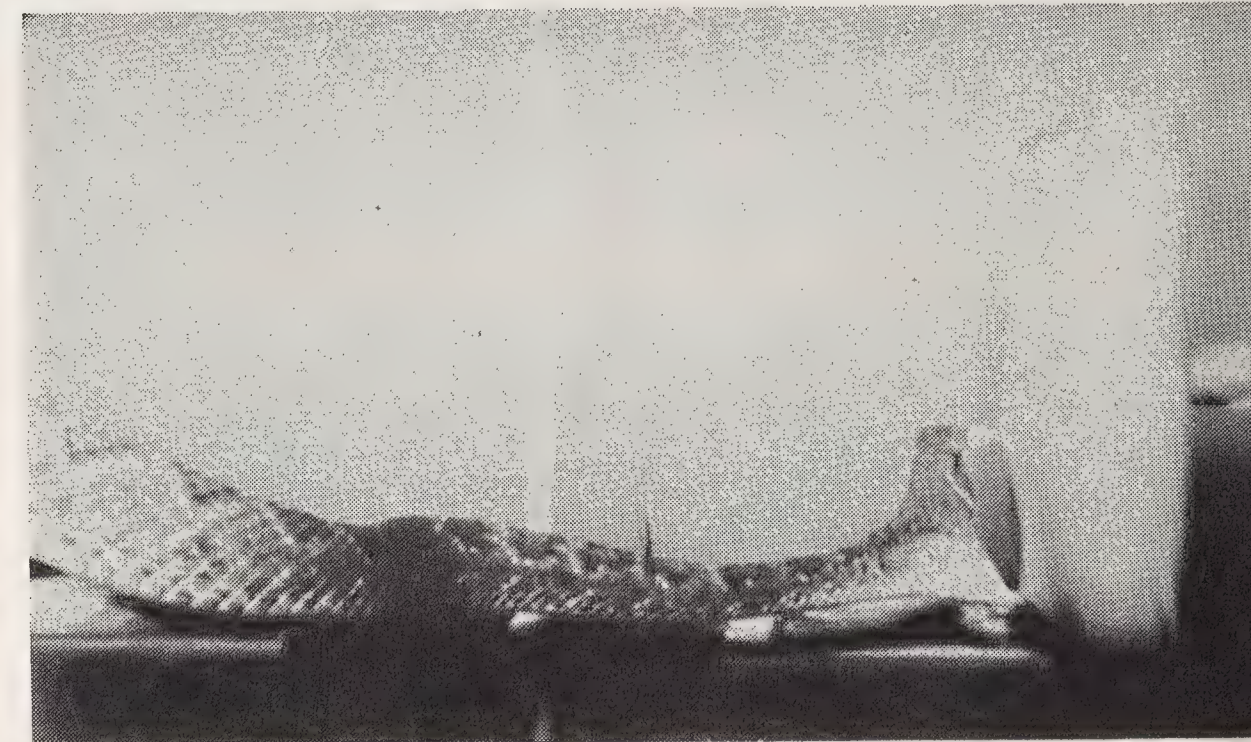
1



2



5



6

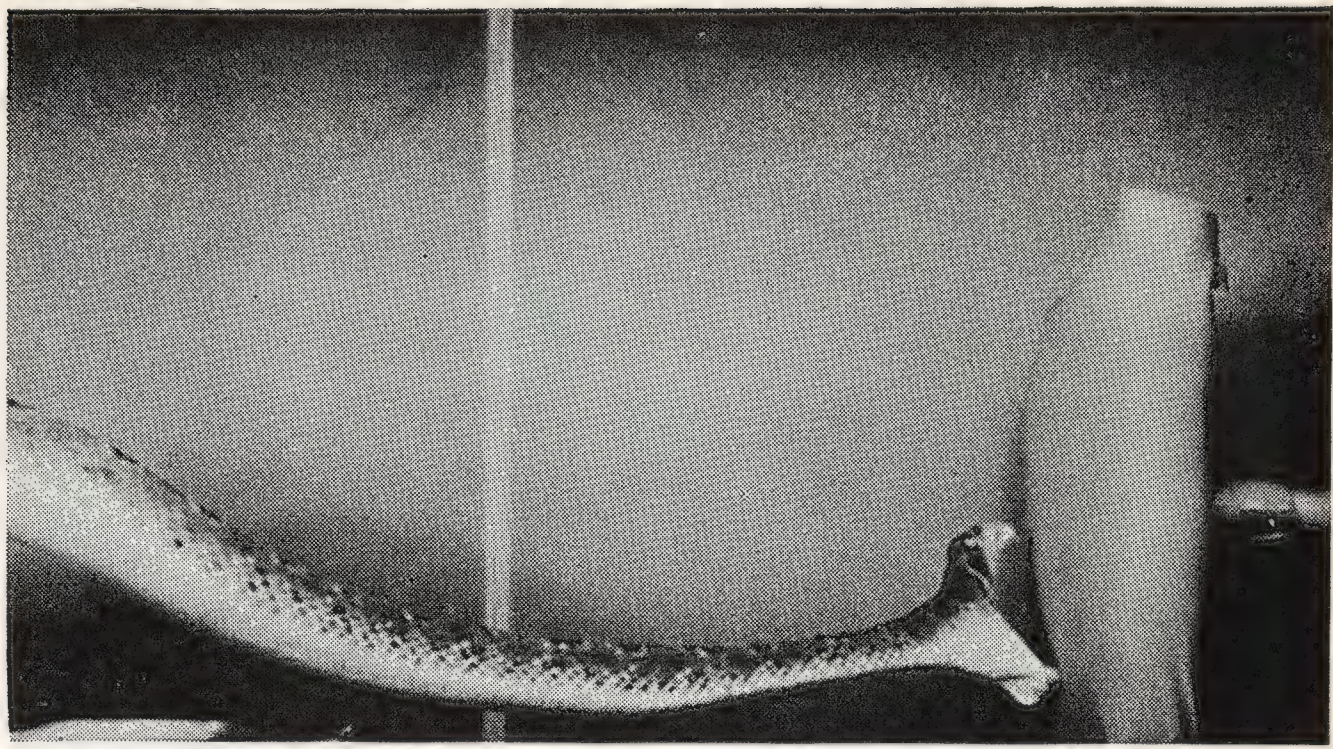
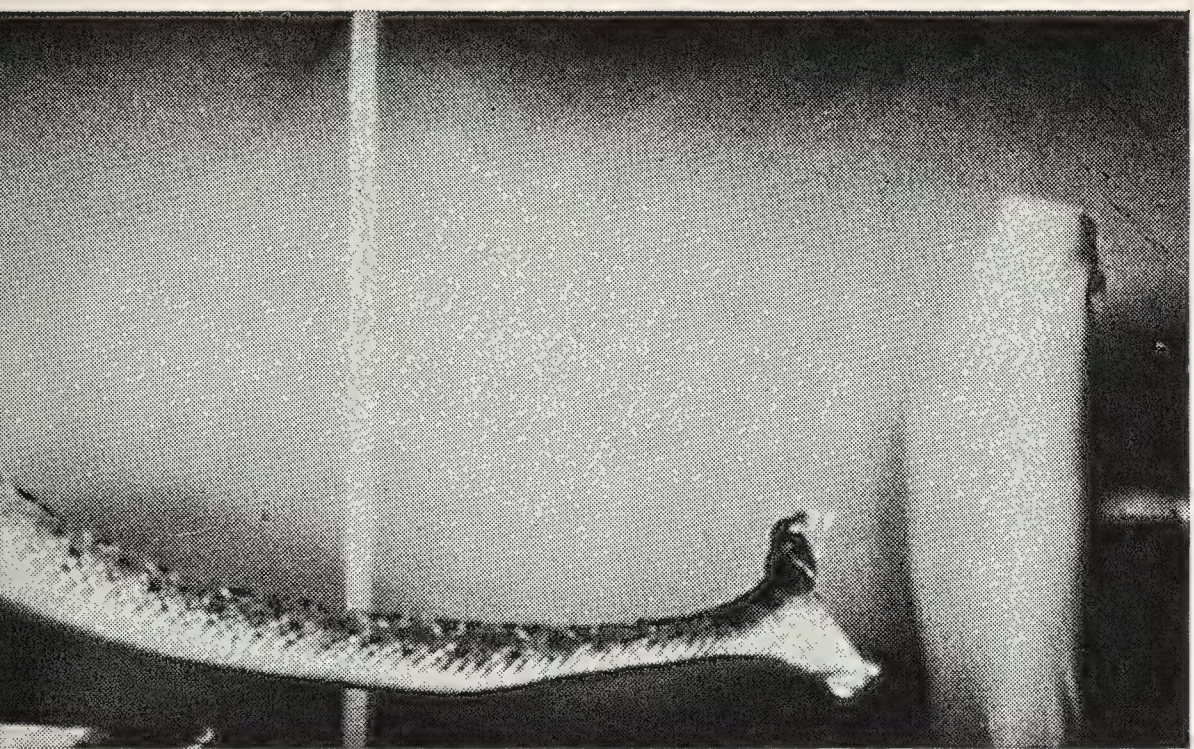
Individual scenes from the motion picture taken at a hundred times normal speed. Scenes 1 to 4 show the snake's head approaching the sponge rubber target; Scene 5 is the stabbing bite, and the remainder of the series show the snake returning to its coiled position of attack.

that promised a flash immediately when the snake plunged forward from its coiled position. This was the closest we could get, we felt, to the workings of the snake's brain; *our* minds had proved incapable of anticipating the snake and its decision to strike; now electronics were to tell us when the snake made up its mind. Actually we trailed the snake's decision to strike by only a few thousandths of a second.

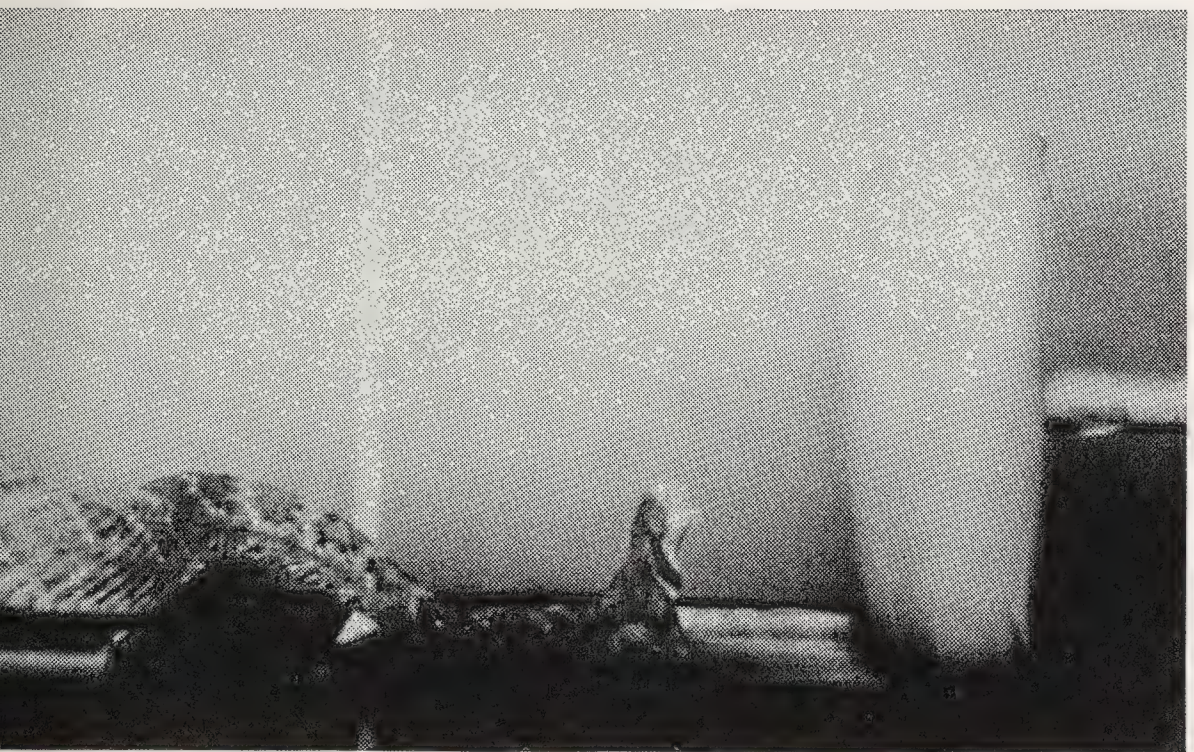
The snake was given a movable wooden platform about 15 by 18 inches, covered with a copper screen connected by a thin, flexible, insulated conductor to the "ground" — the chassis of the "transmitter." The platform was on gliders and could be moved freely anywhere upon the 6-foot by 4-foot table which was our photographic stage. The technically-minded readers of this report may be interested in the circuit of the capacitance relay shown here. It is, actually, not as complicated as it looks, and embodies well-known

principles. Its "antenna" terminated in another area of copper screen stapled to the table in front of the snake's platform, and this was adjusted by trial and error to give a maximum response to the fairly small capacitance of a snake. The device could be made so sensitive that the relay was tripped by the time the swiftly-striking snake's head had penetrated the field for only about two inches.

Our next problem turned out to be the target. The one we prepared originally was a beauty — to us, but not to the snakes. That elaborately prepared device of foam rubber and leather looked pretty in test pictures and had the practical value of enabling us to present it either vertically or horizontally, giving Dr. Oliver a chance to secure evidence on a moot point: when a rattlesnake strikes, does it stab, or bite, or both? The snakes would have nothing to do with the target which suited our needs. What they really



4



8

went for was a mere piece of brown cardboard, the side of one of the flashlamp cartons. At this they would strike viciously on sight, even when it was beyond their reach. We promptly threw away the glamorized target, covered a part of the carton's side with foam rubber and a much larger piece of leather so that the snake had a target worthy of its ire, and our subjects struck at it every time it was presented.

The setup, its electrical, mechanical and human components, was tried and tested. We had to learn how to handle the target: just so, not too much motion and not too little. We had to study the snakes to learn something about their individual behavior, "reach" and the level of their strikes. Two of a batch of six Western Diamond-back Rattlesnakes from Texas were "hot" enough to suit us and of these, one nicknamed "Herman" was all that the heart could desire. Herman had only one thought in life and that was to sink his fangs into any moving object that came within reach. That made it slightly easier for us to synchronize the functional relationship of man, animal and a lot of machinery so that they all

converged upon one fraction of a single second.

Proof that we were synchronizing our efforts had to be gained by photographic means, since the snake's strike seen by the human eye in the blaze of intense light cannot be judged accurately. We mounted a Polaroid film back on a Speed Graphic camera and presented the target. The snake struck, the lights went on, and a minute later we pulled the finished print, which showed us what our high-speed camera would have seen had it been running. Some of the best of the Polaroid test photographs were just what we wanted but the great majority of them were not satisfactory; some showed that the snake had tripped the mechanism too soon, some too late. Each time minute corrections and adjustments had to be made.

The work was fascinating and absorbing, but slow at best, for our snakes could not be made to rehearse indefinitely. They were obviously tired after four to six strikes and we would have to call it a day. Two or three days later they would be full of energy and strike willingly once more. Here, again, we learned something; al-

though the lights went on and the film rolled, the third, fourth and successively later strikes of even a well-rested snake were frequently shams; we saw the rattler shoot out toward the target, open his jaws partly and then, as if he changed his mind, close them and continue onward only to bump the target with his nose. In other "takes" on the motion picture film we saw the snake strike without ever opening his jaws, and even hit the target with the side of his head. It is possible that some of these ineffective strikes were the result of the blinding and confusing flash of light. But since most of them occurred late in the course of a day's experiments, fatigue probably had much to do with it. Sometimes the target was missed altogether, but this would likely be caused by the light.

And then came THE strike, the one and only complete strike fully recorded by the high-speed motion picture camera, in color, so far as we know. It came on April 1, shortly before noon.

Our subject was our favorite actor, Herman, and we had pre-tested him with the Polaroid camera at the beginning of the day's work. It was nicely centered, Herman broke the electronic field early in the picture, and when we saw it we knew that we were ready. Oddly enough, I think all of us had a feeling that this time we were going to get the picture, for Herman was so obviously tense and ready for anything.

The camera was sighted once more, loaded, the flashlamps given a final precautionary twist in their sockets, the electronic equipment was checked and then checked again, the way one does under nervous tension. Herman reacted to our movements, rising on his coils and holding his head in the menacing S-loop that meant business. Dr. Oliver coolly presented the target, jabbing it forward and pulling it back in the jerky, erratic fashion that we knew worked well with Herman. For perhaps ten seconds he feinted and when he sensed that one more approach of the target would unleash Herman's fury he shouted "Now!" and the moment we had been working for was upon us. I pressed the switch that set the camera in motion and its whirring rose to a shrill whine as the film gathered speed — 20, 30, 40 miles an hour acceleration from a dead start. Close beside the camera I alone heard the sharp click of the relay and then there was a

brilliant burst of light as the first flashlamps fired. The glare was too intense for full observation but from my position directly at the side of the snake I could see a gray-brown streak dart forward and the great jaws open a full 180 degrees. Dr. Oliver was more completely blinded than I and saw nothing, but he felt the full impact of the strike on the target and the solidity of the jolt told him that it was a strike squarely in the middle.

In a single second it was all over, the last flashlamps exploding and showering us with sparks . . . the comparative blackness that follows great illumination . . . and all was quiet again and Herman was back where we last had seen him, on the platform, coiled and ready for the next encounter.

Although we tried many times in the days that followed to get other aspects of the strike, the one that was recorded on April 1 turned out to be the only good and complete record obtained during all those weeks of heartbreaking — and sometimes backbreaking — efforts and frustrations. The other views were interesting but incomplete actions, usable only as supplementary or explanatory material.

Our usable film was photographed at 2,400 to 2,500 frames per second, and all in color. All the footage was accurately timed for study and measurement. Motion pictures taken at 2,400 frames (individual pictures) per second produce a "time magnification" of the action of 100 times, when projected at the normal speed of 24 frames per second. In other words, when viewed on the screen, the movement of the snake appears slowed down to one one-hundredth of its actual speed. If Dr. Van Riper's calculation of the average speed of a rattlesnake's head during its strike — 8.1 feet a second — is close to the rate at which our Herman struck, he will be seen on the screen lashing out ferociously at the leisurely pace of about one inch per second.

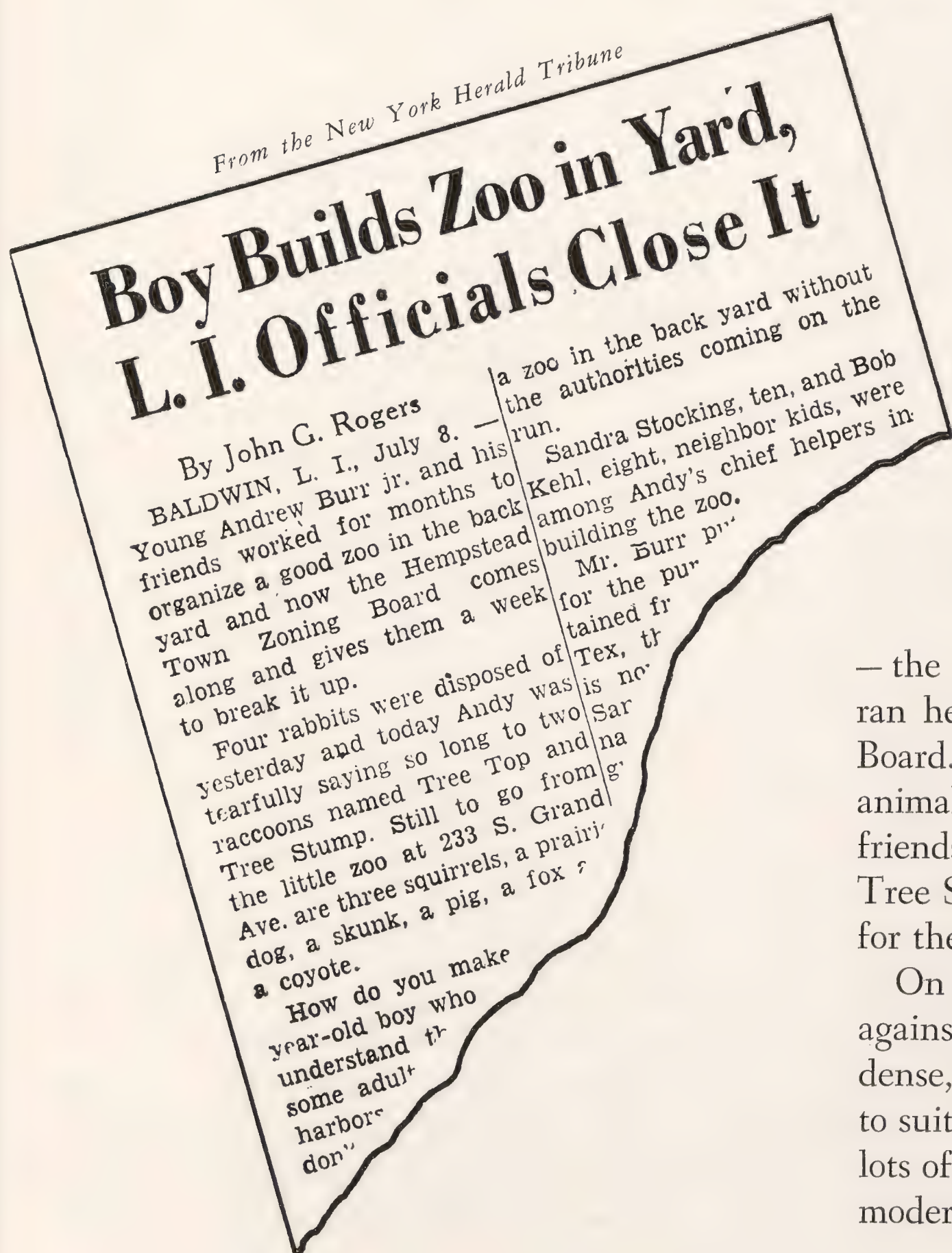
To sum it all up: the total usable footage secured by us in recording the strike of the rattlesnake came to about 100 feet of color film. To accomplish this much, required the skills and technical knowledge and ingenuity of five men over a period of seven months — to say nothing of the services of carpenters, electricians, mechanics and assistant keepers, who became as

excited as the rest of us when we seemed on the verge of success, and exercised their own ingenuity in making whatever "gadgets" we required. Twenty some-odd Western Diamondback Rattlesnakes were flown up from Texas for the experiments. Six thousand feet of Kodachrome film were shot through the high-speed camera, rushed by messenger to the processing laboratory, sped back a few hours later for eager viewing by eyes that lost some of their glee as the wastebaskets began to overflow with discarded film. Some 3,000 flashlamps were fired, in lots of 34 for each exposure. A whole benchful of auxiliary equipment had to be built, tried, discarded and replaced by new electrical and electronic devices . . . but it was worth the effort, for we got what we wanted.

Some of the special problems required specialized knowledge, and when we came to these points we received the wholehearted cooperation of the Eastman Kodak Company of Rochester, N. Y., and the Lamp Division of the General

Electric Company of Nela Park, Cleveland. For the benefit of anyone else who wants to tackle this problem, it should be recorded that the flashlamps used in the Continuous Flash Lighting equipment were G.E.'s #31 Focal Plane Flash Lamps. The Kodak High-Speed Motion Picture Camera, Type III, was used throughout. It was equipped with the Kodak Cine Ektar, 25mm f/1.9 lens which, for the benefit of the photographically-minded, exposed the Kodachrome footage at f/4.5. For an operating speed of 2,400 to 2,500 frames per second, each individual frame was exposed to the light and the action of the snake for about 1/12,000th of a second.

Precision machinery and electronics are reliable tools. But, knowing rattlesnakes as intimately as I have come to do in the past few months, it still seems astonishing and exciting to me that we were able, if only once, to bring men and machines and snake into harmony in that critical split second.



We're Sorry for Andrew Burr, Jr.

— the little boy out in Baldwin, L. I., whose zoo ran head on into the Hempstead Town Zoning Board. We're sorry for every thwarted young animal lover who has to bid farewell to such friends as Tex, the coyote, and Tree Top and Tree Stump, the raccoons. These are hard times for the city child who loves pets.

On the other hand, it is difficult to argue against town ordinances with people piling up in dense, tense communities. Rules have to be made to suit the average. So back-yard zoos must go as lots of other things have been sacrificed to fit our modern ways of living. The neighbors can play

the piano all night but the sunset song of the coyote is OUT. * * *

The next best thing for a boy like Andy Burr is to become acquainted with the New York Zoological Society. At the Bronx Zoo and the new Aquarium the Andys of these times can have animal friends — not exactly their own, but pretty nearly!

Have you ever visited the zoo with one of our younger members? There's a sense of proprietorship in the zoo which comes from Society membership that has its own special glow in the eyes of youth. If your boy is grieving for the lack of a pet see if he won't get a thrill — quite a big thrill — by allying himself with one of the best collections of pets on earth.

New Members of the New York Zoological Society

(Between May 1 and June 30, 1955)

Fellow

Dr. Theodore Kazimiroff

Founder in Perpetuity

Saul Blickman

Life

Mrs. Cornelius R. Agnew
Mrs. Harry Payne Bingham
Mrs. Eleanor Rixson Cannon
John N. Irwin, II
Mrs. Katharine Maynard
Henry Sears
J. Spencer Weed

Contributing

Walter C. Bennett
Louis Britwitz
Louis S. Cates
Jarvis Cromwell
David C. Eaton
Phanor J. Eder
Dr. George F. Egan
Mrs. Osborn Elliott
Howard M. Ernst
Morton H. Fry
Master Thomas F. Garner Jr.
W. French Githens
Miss Marjorie Hillas
Allen S. Hubbard
Mrs. Kenneth Kopelson
Henry G. Leach
Mrs. Huntington McLane
Mrs. E. W. Miles
Com. Morton J. Newburger
Robert Noerr
Mrs. Andrew Oliver
Miss Katharine Ordway
Mrs. Frederick Osborn
Hugh E. Paine

Mrs. Conrad M. Riley

Mrs. B. Ruml

Dean Rusk

Max Y. Seaton

Mrs. David A. Schulte

C. Francis Smithers

Mrs. Read Taylor

William A. Ten Eick

R. E. Tomlinson

Dr. Edwin C. Van Valey

Paul Felix Warburg

Frank Weil

Mrs. Davenport West

Annual

A. Gifford Agnew
Howard Bayne
M. Gould Beard
Mrs. Amory H. Bradford
Miss Florence Briscoe
Ernest Brooks, Jr.
Melville H. Cane
G. Wyman Carroll
Mrs. John C. Crawley
Miss Mary H. Dana
Albert P. Delacorte
John C. Doughty
Hon. David N. Edelstein
Miss Lita Eliscu
Arthur H. Elkind
George Farber
Fred Ferber
Irving Fishman
Samuel L. Fuller
John S. Gallick
Milton S. Geist
Gardner F. Gillespie, Jr.
Rodney C. Gott
Mrs. Francis J. S. Grace
Harold Halliday

Raymond Hochmuth

Mrs. Paul Hoffmann

Mrs. Marianne Holland

Miss Natalie Hollerith

Mrs. James H. Hunter

Mrs. Edward Immerblum

William E. Jackson

M. C. Kaplan

Edward Klauck

Mrs. Charles L. Lawrance

Lawrence Litchfield, III

Mrs. G. Barron Mallory

Harold C. Mayer

Mrs. Eric M. Maynard

Mrs. J. Arrison McCurdy, II

Mrs. Samuel W. Meek

Albert H. Merkel

Mrs. Stanley G. Mortimer, Jr.

Matthew J. Murray

Mrs. Julian S. Myrick

Mrs. Ilse Nast

Mrs. Cheever Porter

Miss Evelyn A. Post

George R. Puckhafer

Dr. F. K. Reid

Mrs. Marjorie Reilly

Mrs. Phyllis M. Ricci

Jacob Robinsohn

Stephen Rosenbaum

B. Schmones

Harvey L. Schwamm

Mrs. F. J. Starzel

Hokan B. Steffanson

Miss Viola G. Stevens

John Storck

Herbert Bayard Swope

Richard Wagner

Louis E. Walker

Miss Grace E. Wallin

Saul Warshaw

Mrs. Edward M. Weld

News from the Conservation Foundation

Changing the Face of the Earth

Dr. Osborn and Mr. Ordway attended the six-day International Conference held at Princeton under the auspices of the Wenner-Gren Foundation on the subject of "What Man Has Done and Is Doing to Change the Face of the Earth." This meeting was attended by eighty selected individuals from seventeen nations and included anthropologists, economists and land-use planners, biologists, hydrologists, oceanographers and other technicians concerned with the life sciences.

Pan American Institute

The Foundation will be represented at the Conference of the Pan American Institute of Geography in Mexico City this month by Dr. Enrique Beltran, one of the leading conservationists in Latin America, who has been associated with the Foundation's work in the study of soil erosion and population problems.

Radio and Television Programs

A thirteen-week radio program reviewing conservation activities and achievements in the United States has been arranged in cooperation with the National Broadcasting Company's Educational Division and is expected to be on the air this fall. In addition, a number of the Foundation's educational films will be incorporated in a new television program to be broadcast from various educational television stations throughout the country.

Jamaica Studies

Mr. George W. Roberts' book on population trends in Jamaica, which resulted from his study sponsored last year by the Foundation, is to be published by the Cambridge University Press this year. Mr. Peter Stern of the Foundation staff has returned to Jamaica temporarily, to complete his study of geographic and economic phases of the population-resource problem in that island.

Dr. Max Nicholson Visits the U. S.

Dr. Max Nicholson, Director-General of the British Nature Conservancy, visited the United States in June at the invitation of the Zoological Society, the Conservation Foundation, the Wildlife Management Institute and the American Committee for International Wildlife Protection. After attending introductory dinners in New York and Washington, Dr. Nicholson visited a number of national parks and forests, wildlife refuges, governmental research stations and state and local watershed developments and reserves.

The I.U.P.N. Atlas

Dr. Osborn has been invited to write the foreword to the World Atlas of Parks and Wildlife Reservations to be published shortly by the International Union for the Protection of Nature. He has also been invited to write a chapter dealing with natural resources and population problems for a new symposium on conservation to be published by the Natural Resources Council of America.

Water Law Survey

The survey, now in progress, of the nature of the growing water problems of the Eastern States is receiving enthusiastic cooperation from federal and state administrators and legislators. The Council of State Governments and state Chambers of Commerce have offered full assistance. Professor David Haber of the Yale Law School, Professor Charles Harr of the Harvard Law School and Professor Richard Arens of the Buffalo Law School are engaged in the study of legal changes which will be needed to enable the East to meet effectively the increasing competition for the limited supplies of water available for domestic, municipal and industrial use as well as for agricultural irrigation. It is expected that this survey will be completed early next year.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Fairfield Osborn and John Tee-Van Receive Honorary Degrees

President Osborn and Director Tee-Van were awarded the degree of Doctor of Science *honoris causa* by New York University and Rensselaer Polytechnic Institute, respectively, in June. Of Dr. Osborn the citation read:

FAIRFIELD OSBORN, an irredeemable Princetonian, the son of a famous paleontologist, was swaddled in academic sheepskin on the campus and weaned on the baccalaureate in 1909. An overseas Captain of Field Artillery in World War I, he quit the rolling caissons for the ravenous coffers of Wall Street, and until 1935 was immersed in the investment business. It was then that the home-grown propensity for natural science turned his career irrevocably in that direction. In 1940 he assumed the mantle of the presidency of the New York Zoological Society once worn by his father, its founder. Eight years later he added to this the presidency of the Conservation Foundation. Leading world figure in the crucial effort to arrest the headlong dissipation of the earth's natural resources, and author of key treatises of the utmost significance on the subject, devoting his life unselfishly and unsparingly to a vast educational effort toward protection against prodigal waste of mankind's basic patrimony, he is every inch a conservationist — and there are a good many inches — and we gladly present him for the doctorate of Science.

Dr. Tee-Van was cited for the doctorate of Science in the following terms:

Rensselaer Polytechnic Institute confers the honorary degree of doctor of science upon JOHN TEE-VAN in recognition of his achievements as a zoologist. Born in Brooklyn, in 1916 he became an assistant in the New York Zoological Society, working under the famous William Beebe, director of its Department of Tropical Research. Since then he has participated with outstanding distinction in scientific expeditions conducted by the Society in various parts of the world, and his steadfast pursuit of research has brought forth important contributions to the zoological sciences, particularly in marine biology.

His increasing stature in the world of science over the years resulted in successive promotions by the Society. In 1952 he was selected as director of the New York Zoological Park, having charge of the New York Zoo and its scientific laboratories in the Bronx, the New York Aquarium, and other installations administered by the Society.

Although he never had the advantage of a formal college education, his attainments are generally recognized as of the highest scholarly order. His definitive

encyclopedia on marine biology promises to be a standard reference work for generations. His natural aptitudes, general ability, and self-taught scientific training more than compensate for any lack of collegiate associations. Numerous learned societies have honored him, including the New York Academy of Sciences, which elected him its president.

The Things People Wonder About!

Fifteen to twenty thousand questions are asked — and answered — in our Question House each year, all reflecting some gap in the public's knowledge of animal life. Some recent *lacunae* we have tried to fill —

What is the bird that alights on people and eats them up?

Does the Electric Eel see when he lights up?

Do Lions snore?

When a duck bites you, do the teeth hurt?

Is it true that the Platypus is the only bird that's a mammal?

THE MORNING'S MAIL

The Reptile Club

SIRS —

I received the Annual Report of the New York Zoological Society. While I was reading it I saw the chapter on the Reptile Department which I found very interesting.

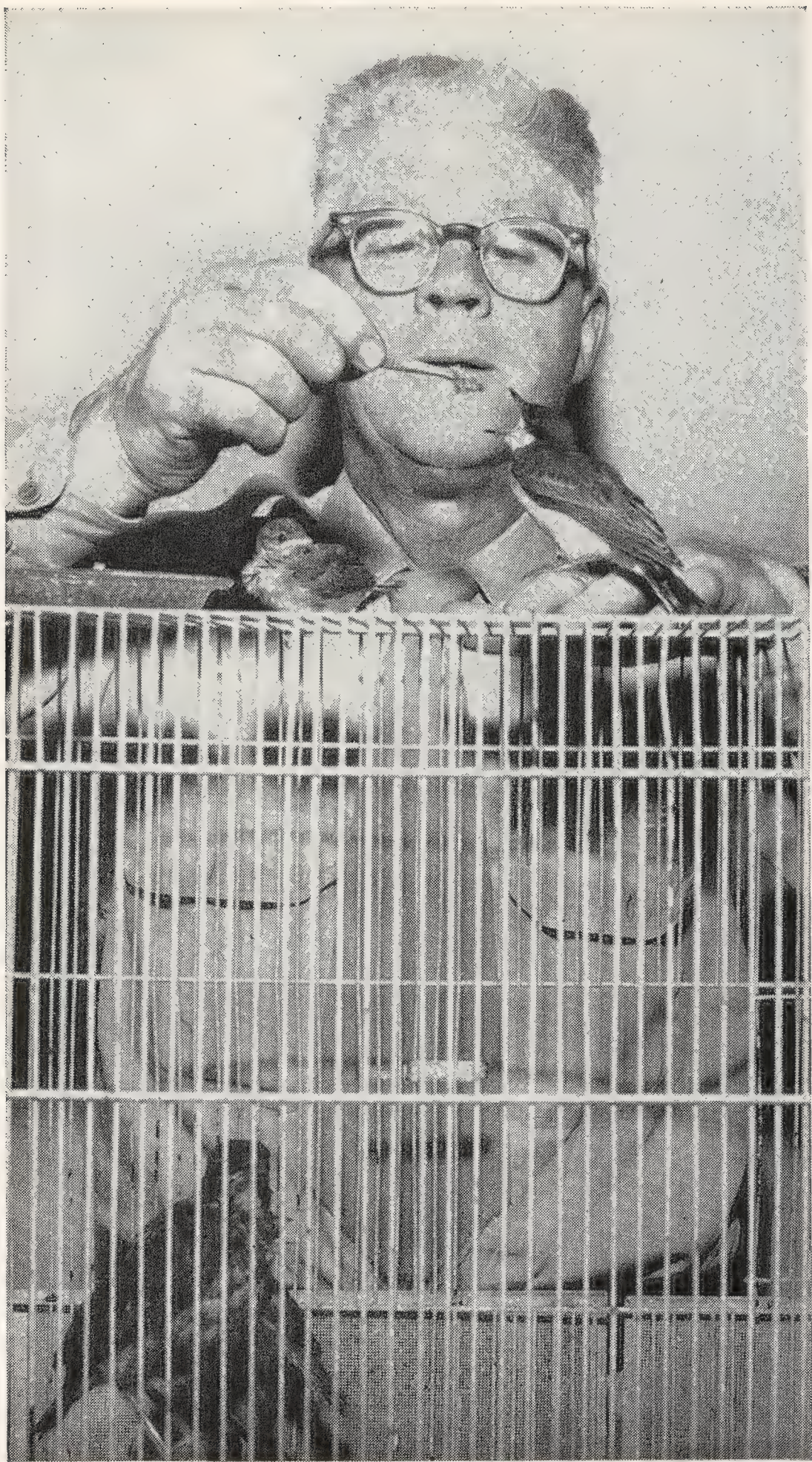
In it I saw that you had started a Reptile Club for a group of young herpetologists. But what I would like to know, is it just for college students who intend to make it their life's work? Or can anyone who is interested in Reptiles join the club?

GEORGE L. MEYER
Closter, New Jersey

Reply by Dr. James A. Oliver, Curator of Reptiles:

We do have a Reptile Club here at the Zoological Park for youngsters of all ages. We have discontinued our meetings for the summer months, but plan to start again in the fall. We will hold our first meeting on Saturday morning, September 24, at 10:30 A.M. in the Reptile House. If you would like to join the group, we will be very glad to have you there at that meeting, and I am sure you would find congenial members of your own age present.

FOSTER FATHER



Headkeeper Scott and feathered friend

From May until mid-August our Bird House takes on some aspects of a multiple nest, with fledgling birds of a dozen species quartered in every room. Young birds that have fallen from the nest, or been rescued from cats, begin to arrive soon after the nesting season starts and although they often tax the time and housing facilities of the department, they are never turned away.

A fledgling Kingbird was brought to the Bird House in June, the first of its kind we have had. The commonest temporary boarders are Robins, Starlings, Grackles, Bluejays and Sparrows, with a sprinkling of Flickers, Kildeer, Bobwhite Quail, Phobes, Bobolinks and Cardinals.

Since many of the birds have to be fed at in-

tervals of fifteen to twenty minutes when they first arrive, the chore of taking care of them is considerable. Occasional specimens are kept for the collection of native birds, but most of them are liberated after a trial period in the "Dome Cage" outside the Bird House, to make sure they know how to find food by themselves.

Congolese Fishes Come to the Aquarium

The fish fauna of the Congo River is one of the richest in the world; only the Amazon has a greater variety. Nevertheless, fishes from the Congo are rare in American aquariums, principally because no commercial collectors regularly operate in the Belgian Congo and because there is no direct air transportation between west Africa and North America. The Aquarium was therefore especially pleased to obtain Congolese fishes from two different sources this summer.

From the Société Royale de Zoologie d'Anvers, through the offices of Director Walter Van den bergh, we received freshwater puffers, two kinds of upside-down catfishes, snakeheads, One-spotted Climbing Perch, Feather-tails and a Dollo's Lungfish. From one of the rare commercial shipments originating in the Belgian Congo we purchased additional Feather-tails, two small *Polypterus* and two *Alestes longipinnis*.

Although small in number, the new fishes are high in exhibit value. Because of their grace and color, the *Alestes* and Feather-tails are particularly attractive. The puffers are capable of blowing themselves up like golf balls. The *Polypterus* have tufts of feathery gills on either side of the head. Such external gills are common among salamanders, but the only fishes that exhibit them are *Polypterus* and lungfish when they are young. — J.W.A.

IN BRIEF

Champion Chimpanzee. In 1945 we purchased a magnificent Black-faced Chimpanzee from the St. Louis Zoological Garden. "Jimmy," as he was called, was then twelve years old and had grown a little too large, old and uncertain of temper to continue his act in the St. Louis Zoo exhibition of trained animals — he had been accustomed,

the story goes, to ride a bicycle while smoking a cigar. As an exhibition animal, with no performances required of him, Jimmy has been superb. We realized that he was of imposing size, but hardly knew how imposing until he was weighed on June 3, and found to weigh 190 pounds. This is, so far as we can discover, a record weight for the species.

A Pair of Cheetahs. Two magnificent young Cheetahs, hand-reared, have been placed on exhibition in the Lion House. We have not exhibited Cheetahs since 1940 and the pair is therefore especially welcome. Gentle and well-adjusted as these animals usually are, they do not appear to have bred in captivity in any zoological collection. There has been much speculation about how fast they can run. Estimated speeds go up to 70 miles an hour, but the best clocked record (on a dog track by a noted scientist) is only 44 miles an hour.

Busy Miss McCrane. For a number of years our Education Department has offered the services of a member of its staff to public and private schools, to give talks and exhibit a number of small animals. Requests for the talks far outrun the ability of the department to keep up with them. In one month in late spring Miss Marion McCrane of the department gave 45 talks to a total of 4,530 school children.

PUBLICATIONS OF INTEREST

THE SAGA OF THE GREY SEAL. By R. M. Lockley. Illus. 13 photographs in black and white, numerous line drawings and two maps. Pp. vii + 149. The Devin-Adair Co., N. Y., 1955. \$4.00.

Originally published in Great Britain under the title "The Seals and the Curragh," this book is an altogether fascinating yet completely factual account of a breeding season during which the author lived in close contact with seals on the coast of Wales. Mr. Lockley has acquired an enviable reputation for the charm and accuracy of his nature reporting. The present volume is well in accord with the expectation engendered by its predecessors. — L.S.C.

EVOLUTION OF THE VERTEBRATES. By Edwin H. Colbert. Illustrated by Lois Darling. Pp. xiv + 479. John Wiley & Sons, Inc., New York, 1955. \$8.95.

Dr. Edwin H. Colbert records here "a history of the backboneed animals through time." His account is presented in scholarly fashion, but in language that the layman will readily comprehend. The illustrations greatly enhance the text and include several novel methods of presentation that add to their clarity. The

book will serve as an excellent elementary text or handy reference for all who are interested in the story of the backboneed animals and their evolutionary history. — J.A.O.

STRAY FEATHERS FROM A BIRD MAN'S DESK. By Austin L. Rand. Chapter-head cartoons by Ruth Johnson. Pp. 224. Doubleday & Co., Inc., Garden City, N. Y., 1955. \$3.75.

Primarily a systematist, as indicated by his position of Curator of Birds at the Chicago Natural History Museum, Dr. Rand's secondary devotion has always been to the living bird and its behavior. In sixty brief, unrelated chapters, he has recorded a great variety of observations on the ways of birds. Most of them are his own but when the work of others is drawn upon, credit is given in a list of references. Miss Johnson's amusing drawings and some of the chapter titles suggest a lightness of treatment that is not borne out by the text. While the author has used a readable and engaging style, fact and conclusion are as sound throughout as is to be expected of a scientist of his standing and experience. — L.S.C.

THE BAFUT BEAGLES. By Gerald M. Durrell. 22 illustrations in black and white from drawings by Ralph Thompson. 238 pp. The Viking Press, New York, 1954. \$3.75.

THE ODYSSEY OF AN ANIMAL COLLECTOR. By Cecil S. Webb. Fifty-one illustrations in black and white from photographs and ten from drawings by L. R. Brightwell and W. C. Osman-Hill. Introduction by Geoffrey Ververs. Longmans, Green & Co., New York, London and Toronto, 1954. 368 pp. \$6.50.

Seldom indeed do two books concerned with the collecting of living zoological specimens arrive simultaneously on one's desk. But had they been separated in time by a span of years, their style and content could not have been more different.

The title of Mr. Durrell's book forecasts the treatment, for his "beagles" are a team of native hunters, not a pack of the popular little hounds. It should be said at once that Mr. Durrell writes extremely well, an ability that will fascinate the casual reader as it invariably has the literary reviewer. The first nine chapters have to do largely with the chief, known as the Fon, of the district of Bafut, in the Cameroons of West Africa. A scattering of descriptions of local field trips serves as a foil for the doings of the Fon but leaves the nature-minded reader with a vague feeling of frustration. There is compensation, however, in the final three chapters, when the Fon has been left behind and the author is free to deal with matters more directly related to his project. The chapter called "The Forest of Flying Mice" outweighs even the Fon himself in interest.

Mr. Webb's book, originally published in England as "A Wanderer in the Wind," is an entirely different matter. It is a straightforward, factual account of the experiences of a man who, now settled down as Superintendent of Dublin's famous Zoo, still ranks with Goodfellow, Fred Shaw Mayer and Charles Cordier as one of the world's most expert zoological collectors. During the long years when one expedition followed another, Mr. Webb sought his treasures in many parts of Africa and in India, Indo-China, South America and Australia. The outbreak of World War II found him in Madagascar and held him there for six years. General "literary" reviewers will not be as favorably impressed by Mr. Webb's writing style as by Mr. Durrell's, but it is equally certain that the zoologically inclined will find more solid satisfaction in "The Odyssey of an Animal Collector." — L.S.C.



SUMMER'S THE TIME FOR ODD ALLIANCES

Johnny comes home from Camp Wahwahwhosit with a young raccoon. Binda has made a famous collection of frogs, while Baby Jane spent the summer by the sea rounding up starfish and other non-transportable livestock. It's all so reasonable and all so impossible, what is there to do?

The best thing to do is to give these young people a lecture about the sin of disturbing the ecology — "balance of nature," that sort of thing — release the animals and divert the children by joining the New York Zoological Society. At the Bronx Zoo, Johnny and Binda can revel in frogs and raccoons and Jane can soon go starfish-mad at the Aquarium.

And you won't have to buy one ounce of fish-food, bird-seed or whatever Johnny's been feeding his raccoon. It's so simple.

Just fill in the card bound into this magazine and mail it. Back will flash an application blank, and from then on you can have the Animal Kingdom in control.

SO YOU'RE GOING TO THE BRONX ZOO! HERE'S HOW—

AUTOMOBILE. *From east New York City and Long Island:* East River Drive N. across Triboro Bridge; Northeast on Bruckner Blvd. to Bronx River Parkway; North to Exit 5 for Bronxdale Parking Field of Zoo, or Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field.

From Long Island: Across Bronx-Whitestone Bridge, continue on Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), thence W. to Zoo.

From west New York City and New Jersey via tunnels: Henry Hudson Pkwy. N. to Dyckman St. and Broadway; N. on B'way to 207th St.; turn E. on 207th St., Fordham Rd. and Pelham Pkwy. to Zoo.

From New Jersey via George Washington Bridge: Through tunnel at east end of bridge, up ramp marked "Bronx-Bronx

Whitestone Bridge," E. to University Ave., N. on University to Fordham Rd., E. on Fordham to Zoo.

From Westchester and Connecticut: Merritt Pkwy. S. to Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), OR Bronx River Pkwy. S. to Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field, or Exit 5 for Bronxdale Parking Field.

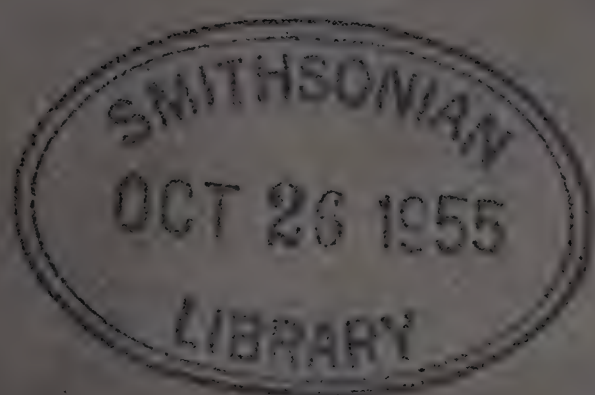
From western Westchester and upstate: Sawmill River Pkwy. S. to Moshulu Pkwy., skirt Botanical Garden southward to Pelham Pkwy., turn left to Pelham Pkwy. gate and Fountain Circle Parking Field.

SUBWAY. *West Side (IRT):* Northbound East 180th St. Express to 177th St. Walk N. to Zoo.

East Side (IRT): Northbound 241st St.-White Plains Rd. Express OR East 180th St. Express to 177th St. Walk N. to Zoo.



ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT Fairfield Osborn	VICE-PRESIDENTS Alfred Ely Laurance S. Rockefeller Donald T. Carlisle	SECRETARY Harold J. O'Connell	TREASURER David H. McAlpin
		ASSISTANT TREASURER Percy Chubb, 2nd	

EXECUTIVE COMMITTEE

Laurance S. Rockefeller <i>Chairman</i>	<i>Class of 1956</i> Archibald S. Alexander A. Raymond Dochez Robert G. Goelet De Forest Grant Eugene Holman Warren Kinney William De Forest Manice Harold J. O'Connell Landon K. Thorne J. Watson Webb
George F. Baker, Jr. John Elliott Alfred Ely Robert G. Goelet De Forest Grant David H. McAlpin Robert Moses Harold J. O'Connell Fairfield Osborn Edwin S. Webster	

BOARD OF TRUSTEES

<i>Class of 1957</i> Robert E. Blum Percy Chubb, 2nd C. Suydam Cutting Alfred Ely Marshall Field Childs Frick Henry Clay Frick Archer M. Huntington David H. McAlpin Richard C. Patterson, Jr. John H. Phipps	<i>Class of 1958</i> George F. Baker, Jr. F. Trubee Davison John Elliott Robert I. Gannon Peter Grimm Fairfield Osborn Eben Pyne Laurance S. Rockefeller Archibald Roosevelt John M. Schiff Henry Sears Edwin S. Webster
--	--

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Richard H. Manville *Curator, Mammals*
Grace Davall *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandal *Assistant Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch *Assistant Curator, Education*
Quentin Melling Schubert *Superintendent,
Construction and Maintenance*
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. *Research Associate in Ichthyology*
Harry A. Charipper *Research Associate in Histology*
Homer W. Smith *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez Caryl P. Haskins
Alfred E. Emerson K. S. Lashley
W. A. Hagan John S. Nicholas

AFFILIATES

C. R. Carpenter, *Co-ordinator*
Animal Behavior Research Programs
L. Floyd Clarke, *Curator*
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen Samuel H. Ordway, Jr.
George E. Brewer, Jr. Hugh J. Ross
Donald T. Carlisle Robert G. Snider
John C. Gibbs Peter M. Stern

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

Cheetah *Sam Dunton* Cover

The Cheetah—The Mildest
Cat *William Bridges* 130

Newsletter from Karachi
William Beebe 135

How's the New Aquarium
Coming Along?
Christopher W. Coates 137

The Fable of the Sloth
and the Cheetah
Donald T. Carlisle 139

Zoo Picture Pages
Photographs by
Sam Dunton 140

The Riddle of the Ridley
Archie Carr 146

News from the
Conservation Foundation 153

Behind the Scenes 154

Vol. LVIII OCTOBER 1955 No. 5

Animal Personalities

THERE IS A COMMON IMPRESSION that human beings hold a monopoly, so to speak, as to differences in personality. Nothing could be further from the truth for actually there are wide variations of individual characteristics even among wild animals of the same kind. In passing, everyone who has kept dogs is quite aware of the differences between individual dogs but we explain this by the fact that they are domesticated and just assume that they show these differences because of their proximity to man.

The reasons for differences in wild animal personalities are difficult to explain. In people we can trace causes that may stem from their heredity, from their home life, or from the social influences of the community in which they live.

One of the articles in the current number of this magazine contains observations regarding the disposition of the cheetah, without doubt the most amiable and tractable of all wild felines. Why, one may ask, does this particular animal possess a behavior pattern different from that of other closely related animals, such as leopards or tigers, which results in such amenability to people? The answer is hard to come by. Even more difficult of explanation are the variations in disposition observable in many of the so-called lower forms of animal life, such as birds. Anyone who keeps a succession of individuals of the same species of wild birds in this home will note the fact that each individual differs in its characteristics. The Curator of our Aquarium, believe it or not, even goes so far as to say that he has observed such differences in fishes of the same kind.

One of the liveliest fields of study in zoology is that devoted to animal behavior. There is good reason for this, just because there are so many things about animals that we do not yet understand. Perhaps if we knew more about them we could come to a somewhat better understanding of ourselves.

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

OCT 20 1955

The Cheetah—

THE MILDEST CAT

By WILLIAM BRIDGES

THERE'S NO DENYING that some of the old, high gusto has gone out of the animal business. At the end of June we acquired two lovely young Cheetahs from Italian Somaliland. Like their predecessors over the years, they came in stout wooden crates conveniently equipped with built-in drinking pans and hinged slats for easy feeding. A rattling, bouncing truck delivered them with no more fanfare than if they had been boxes of frozen fish.

But in the 15th Century they did things with real style. Marie of Burgundy had her own tiny zoo, and she, too, acquired a Cheetah. It, however, "crossed Mt. Cenis in mid-winter on the rump of a horse, muffled up in a fur jacket and a green-embroidered cape."

Ten to one *that* Cheetah didn't arrive unheralded. We can only speculate whether it ever fell off the horse, and how it kept its tail warm, and whether it had a tendency to leap down and chase rabbits, cape or no cape. But the sparse record does provide a pungent illustration of the gentleness and tameness of this great cat, so that one wonders whether our own Cheetahs might have travelled with equal casualness. Probably not; wayfarers at medieval inns were more tolerant of animal fellow-travellers than the pilots of freight planes and the drivers of delivery trucks.

Nevertheless, there are almost no instances of a Cheetah attacking a man. That is a strange thing. Of what other cat animal — even the house cat — can it be said that it can scarcely be provoked into attack under any circumstances? Theodore Roosevelt, it is true, once saw a Cheetah make "a determined charge," and another traveller, in Southwest Africa, was actually attacked by a pair of the animals. He did not take it seriously,

however, concluding that the assault was "unpremeditated and caused by panic." Even African natives, who seldom underestimate any animal's ability to retaliate, treat the Cheetah with little ceremony.

It would certainly seem that an animal that since ancient times has been used by man for hunting game (as he would train and use a falcon) has long been ripe for domestication, yet no one has ever domesticated the Cheetah. Professor Hediger of the Zurich Zoo has an interesting paragraph on that point in his recent book, "Psychology of Animals in Zoos and Circuses."

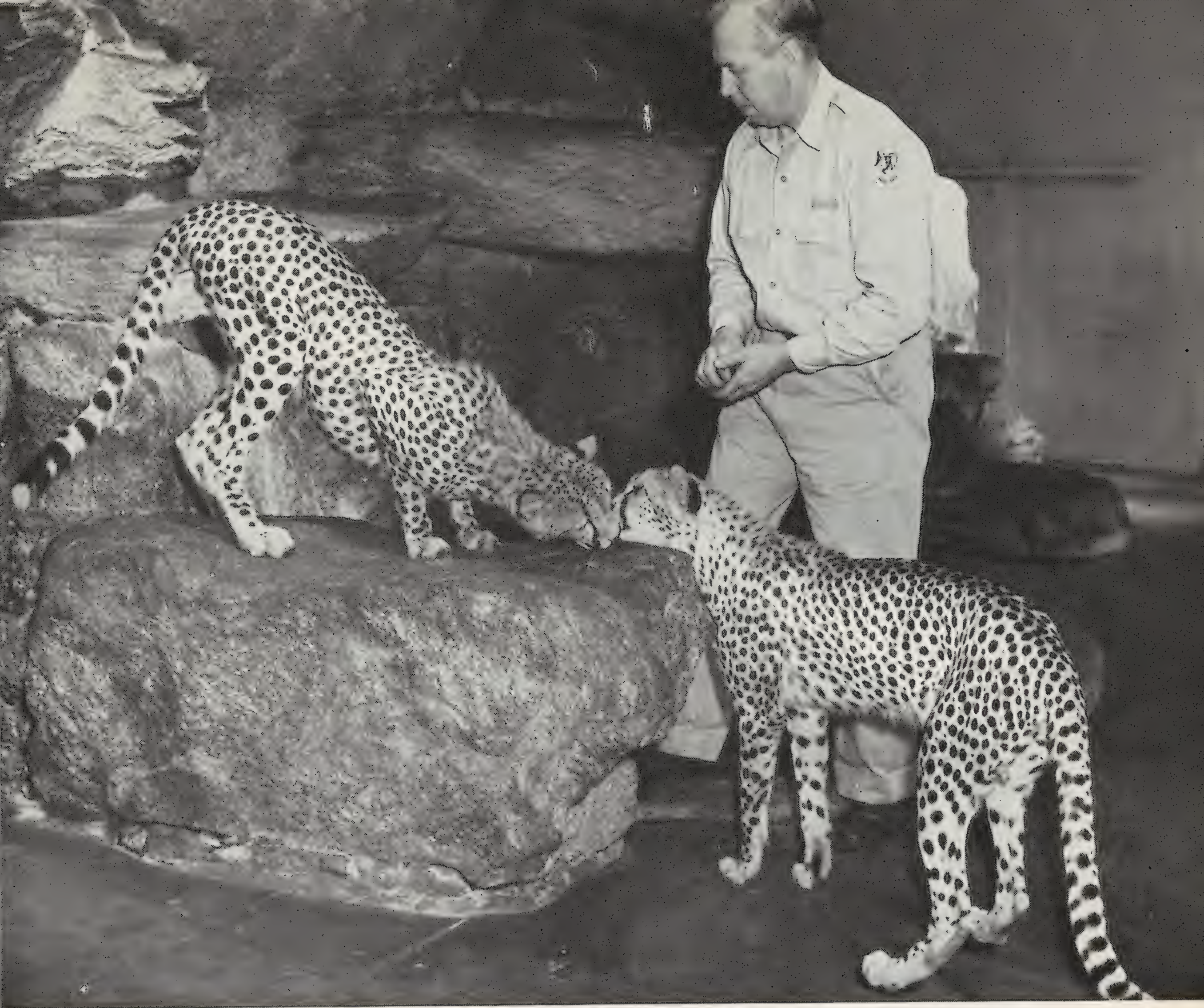
"Another pre-requisite on the animal's part," he wrote, "is its capacity for being bred in captivity, as domestication, in contrast to individual training, depends upon inbred influences working through generation after generation. This is probably the reason why the cheetah, for example, cannot be domesticated, although it is otherwise to a considerable extent favourably disposed. Up to the present, no zoo in the world has managed to breed these lovely, elegant spotted cats."

* * *

EVERY ZOO-GOER or reader of books about wild animals knows three things about the Cheetah: it is the fastest animal on earth, the Indian princes use it for hunting antelopes, and it has non-retractile claws like a dog. One, at least, of those beliefs is probably true.

There is general agreement in zoological literature that the Cheetah is the swiftest mammal alive today. But how swift is it? Roosevelt & Heller in their "Life Histories of African Game Animals" summarized opinion in general terms:

"The Cheetah kills its game in fair chase, for it is perhaps the fastest animal on earth for a



quarter of a mile, or perhaps half a mile. It stalks up to within a hundred yards or so, and then gallops into the fleeing quarry, but it is winded in a long run."

As for actual timed speeds, R. Meinertzhagen writing in *The Ibis* (Vol. 97, No. 1, 1955) cited his own timing of a Cheetah chasing an electric hare on a dog racetrack in London. He made three counts with a stopwatch and came up with a figure of 44 miles an hour. Reference books often cite 70 miles an hour as a Cheetah's maximum, although one book published in India makes the astonishing claim that "Tested against a motor car it was found that the animal could cover half a mile in 20 seconds." That is at the rate of 90 miles an hour. Whew!

There was a time when it was generally true that Indian princes used the Cheetah for hunting

Our young Cheetahs are a pair and were a little more than a year old when they came to us at the end of June. Keeper Fred Martini of the Lion House found them extremely friendly and quite playful.

antelopes. Some individuals still do, but the sport is certainly not as popular and common as it was, say, a hundred years ago. Indeed, the Cheetah has been all but exterminated in Asia and any hunting leopards that are still so employed are said to be imported from Africa — where, too, they are by no means as plentiful as they used to be. The reason for their universal decline is not hard to understand: their natural prey has thinned as the human population spreads and cultivates, more people have firearms, the Cheetah is not by nature fierce and intractable, and its spotted coat brings a fancy price.

The belief that the Cheetah's claws are dog-like rather than cat-like arises from the fact that it has no sheaths into which it can retract its claws. Thus they are always bared.

* * *

WE ARE NOT LIKELY ever to know exactly where and when someone had the idea of training this wild animal to hunt for man, under control. The Egyptians are supposed to have employed Cheetahs and Lions for hunting purposes in the 18th and 19th Dynasties. They went on using Cheetahs, but showed their practical sense by gradually substituting dogs for Lions. The Romans exhibited Cheetahs in their menageries. Probably they never even experimented with throwing Christians to the Cheetahs in the arena; it would have been a waste of time.

It should not be inferred, however, that Cheetahs never bite, never display aggressive behavior, are simply large tabbycats. They are mild indeed in comparison with a Tiger, a Lion or a Leopard, but a wounded or trapped Cheetah will snarl and strike with its claws and even its playful bites are fun only for the Cheetah. It is just that they are readily brought to accept human beings, even when captured as adults (as the Indian Cheetah-hunters used to prefer to do, when they were acquiring them for the use of the princes). A traveller in India in the 1st Century has recorded a pleasant sidelight on animal handling in those days. He was surprised to see Lions, Leopards and Cheetahs wandering through the palaces, at complete liberty, and asked how they were tamed.

"He was told that they must not be beaten, for beating made them wild and irritable; neither should they be handled too gently or coaxed too much, for they would become too proud and feline; they should be handled with calm friendliness, with mixed caresses and threats."

Professional Cheetah-trainers in India used to say that the animal could be trained for hunting in six months. As befitted valuable animals, they were not kept in a cage, but were usually given a low native bedstead to lie on and were simply chained to the wall of the house. Why the professionals preferred to train adults rather than juveniles is perhaps connected with a feeling that animals so readily tamed would not be savage enough for effective hunting if they had been thoroughly indoctrinated in human ways since

babyhood. Or perhaps waiting for the babies to grow up to hunting size was tedious. The same belief is common among Hindustan falconers.

At any rate, quite young Cheetahs *can* be made into hunters. In the last century Dr. Jerdon had a baby Cheetah named Billy at his station in India and Billy was "gradually getting into the way of running down antelope, when Dr. Jerdon was ordered off on field service."

It is regrettable that we seldom know much about the actual capture of animals that come to the Zoological Park; of our young Cheetahs we know only that they were born in 1954 and were hand-reared from the time they were two months old. Probably they were *not* captured by the traditional methods of the Indian shikaris. These men assert that the Cheetah feeds only every third day and spends the other two sleeping off the feast in its den. On the morning of the third day the animal goes to a particular tree, where it whets its claws and "after having relieved himself in various ways and played about with such of his comrades as may be there, they go off on a hunting expedition." That habit of resorting to one customary tree is — or was — the means of the animal's undoing.

Hunters of Cheetahs were said to have rigged nooses of antelope sinew on the ground at various angles and distances from the scratching tree, and to have hidden in a blind until the Cheetahs showed up for their relaxation. A twitch of the noose, and the animal was caught.

The method of hunting with a Cheetah has been described many times but Sir Samuel Baker's account is worth transcribing again:

"In this sport all persons, excepting the keepers of the animals, are simply spectators, and no interference is permitted. Each chita occupies a peculiar cage, which forms the body of a cart, drawn by two bullocks. When game is expected, the chita is taken from the cage, and occupies the outside seat upon the top, together with the keeper. The animal is blinded by a hood similar to that worn by a falcon, and it sits upright like a dog, with the master's arm around it, waiting

The Cheetahs had never seen our Staff Photographer before he arrived to take their pictures, nor had they ever seen a photographer's camera bag. They had no fear of either—only amiable curiosity.

to be released from the hood, which it fully understands is the signal that game is sighted."

On the hunt described by Sir Samuel, a herd of about twenty Blackbuck was encountered in a flat, open area with scattered bush.

"A chita was now taken from its cage, and it at once leaped to the top, and sat with its master, who had released it from the hood. Again the

cart moved forward for seventy or eighty paces, and two bucks were seen trotting away to the left, as if they had caught a glimpse of the approaching cart. In an instant the chita was loosed. For a moment it hesitated, and then bounded forward, as though looking for the lost game. We followed quietly upon horseback, and in a few seconds we saw the two bucks about a hundred



and twenty yards distant, standing with their attention fixed upon us. At the same instant the chita dashed forward with an extraordinary rush. The two bucks, at the sight of their dreaded enemy, bounded away at their usual speed, with the chita following, until all the animals were lost to view in the scattered bushes. We galloped forward in the direction they had taken, and in less than three hundred yards arrived at the spot where the chita had pinned the buck. This was lying upon its back without a struggle, while the firm jaws of its pursuer gripped it by the throat. The chita did not attempt to shake or tear the prey, but simply retained its hold, thus strangling the victim, which had ceased all resistance."

This account makes no mention of the blow by which the Cheetah seems to stop the fleeing game. Other reports tell of it bowling the animal over before seizing the throat, and the dew-claw is said to be used as the main weapon of attack.

Various narratives of hunting with the Cheetah agree that at the end of the chase the keeper cuts the throat of the prey, catches the blood in a bowl, and offers it to the Cheetah, which thereupon releases its grip on the throat. The hood is then replaced on the Cheetah's head and it is lead back to its cage.

Substitute a jeep for a bullock cart and the hunting scene described by Sir Samuel Baker some seventy-five years ago is probably very like hunting with a Cheetah today.

* * *

"HUNTING LEOPARD" is an alternative common name for the Cheetah and scientifically it is known as *Acinonyx jubatus* Erxleben. There are about a dozen subspecies and some authorities recognize another full species, *Acinonyx rex* Pocock, which is found only in Southern Rhodesia and differs from the familiar Cheetah by having a strong pattern of black stripes and blotches. As far as I know, nobody has ever exhibited the King Cheetah alive; in any event, it may be just a color mutant of the common Cheetah.

Originally Cheetahs occupied an enormous area — virtually all of the dry or semi-arid parts of Africa and similar regions in Asia, from India and Russian Turkestan to Syria, Palestine and Arabia. Today it is rare or extinct in many places

where once it was common. Just *why* it is rare or extinct is illustrated by a photograph in the *Journal* of the Bombay Natural History Society (Vol. 47, No. 4, 1948) showing a proud sportsman standing over the bodies of three male Cheetahs shot by the Durbar of the state of Korea in the Central Provinces of India. The editors of the *Journal* comment:

"That anybody with the slightest claim to sportsmanship — and the general run of Indian princes justly pride themselves on that — should be so grossly ignorant of the present status of the Cheetah in India, or knowingly so wanton as to destroy such a rare and harmless animal when he has the phenomenal good fortune to run into not one but three together — probably the very last remnants of a dying race — is too depressing to contemplate."

The animal is interesting enough to repay a much more considerable study of its natural history than appears to have been made. It frequents fairly open country, sometimes stony ridges as well as sand-veld and "dry" forest. Several accounts speak of it as hunting (on its own account) in the early morning or late afternoon during the hot season — even during moonlight nights. In cool or cloudy weather it may be on the move at any time during the day. Medium-sized antelopes are its usual prey. Rarely it kills sheep, goats and ostriches, but seemingly not often enough to be considered a real pest anywhere. Carrion it disdains.

It would appear to be "reasonably" monogamous and the young, 2 to 4 in number, are born after a gestation period said to be "about 90 days." The fur of the young Cheetahs is uniformly gray, but parting or clipping the fur reveals dark spots beneath; these become apparent on the surface at the age of about 3 months.

One Cheetah taken in northwestern Rhodesia weighed 136½ pounds, and another and unusually large specimen stood 2 ft. 11½ in. at the shoulder. On an average, the body length is about 4½ feet, and the tail 2½ feet. In the Ghiza Zoo in Egypt a Cheetah lived for 15 years 7½ months.

We will never, perhaps, have a chance to test our own youngsters for speed, and certainly they will have no opportunity to run down our herd of Blackbuck. It is enough that their playful friendliness delights visitors to the Zoo.

Newsletter from Karachi

As reported in the May-June issue of ANIMAL KINGDOM, Dr. William Beebe and Miss Jocelyn Crane of our Department of Tropical Research have been spending the summer in Singapore — Dr. Beebe revisiting scenes familiar to him forty-five years ago when he was preparing to write his "Monograph of the Pheasants," and Miss Crane starting a world-wide, five-year study of fiddler crabs and their relatives. As usual during Dr. Beebe's field trips, he sends a monthly report for circulation among Trustees and officers of the Zoological Society. The following is extracted from his newsletter from Karachi en route. In the next issue Dr. Beebe will write more extensively about the zoos of Southeastern Asia.

THREE DAYS of reasonably calm steaming covered the reach through the Arabian Sea from Aden to Karachi. My first sea-snake was swimming well east of Aden, almost their westward limit. Hundreds of small flying-fish skittered ahead of us, many sheltering beneath dense masses of Salpa. A small red-brown Shark, four white Boobies and several small Shearwaters completed our list of marine life. Two sand-colored desert grasshoppers were ship stowaways from Aden until I captured them.

Karachi proved to be, for us, the essence of the East. We saw not a white face nor anything which reminded us of home. This applied even to the birds; scavenging Gulls were replaced by Kites which daintily picked up bits of food from the water with their claws. House Crows were as abundant and tame as are English Sparrows at home.

After hailing a taxi we remembered that we had no rupees or annas, and it was Sunday, the banks were closed and the hotel was far off. The taximan said happily "We trust you." (New York papers please copy!)

Scarcely had we left the water-front streets than we ran into traffic, dense as a Monday morning on our West Side Drive, but in character a combination of Arabian Nights plus Alice in Wonderland. Immense buses hooted their way in circles or zigzag lines. Their brakes were in constant use and with such abruptness that turbans flew off and saris came unwound at every full stop. Surging around us were topless jeeps with outrigger seats, tricycles with the driver pedalling and guiding with a rudderlike handle, crammed behind with two or four people. Then came a donkey cart with the patient beast munching at the stuffing of a burst cushion on the vehicle in front. As I watched, the donkey leaped forward as a camel nipped him from behind. These great beasts drew a variety of carts loaded with people or produce. The drooling lips of one almost came in the taxi window. All possible spaces between two-, three- or four-wheeled vehicles were occupied by static or slowly wandering Zebus, from full-grown bulls to small calves, dreamy-eyed, utterly undisturbed by the furor all about them. When the spirit moved them they slouched slowly to the side of the street, paying no attention to camels, buses or horse-drawn ancient victorias. I saw more than one near the gutter, lying down and chewing their cuds.

Disengaging ourselves from this maelstrom of a circus we arrived finally at one of the gates of the Zoo. There seemed to be a riot in progress but the heart of the trouble was only two men quarreling about the price of a small sweetmeat, the only weapons being anathemas and vituperations.

The Zoo was very large, acres and acres in extent, with main roads straight and of great length, and winding, side-connecting paths. All were of gravel, wide and stone-bordered, separat-

ing lawns, palms and flower beds. Especially striking were great banyan trees with their forests of descending aerial roots.

The exhibits were well kept and clean but small and separated by long stretches of park foliage and only when close were the cages visible. The wiring was very poor, with patches upon patches of dilapidated wire, and bars out of all proportion to need of strength and size. A large flying cage contained a score of varieties of common pigeons, another of hundreds of grass parakeets. There were also a beautiful showing of flocks of lemon-crested and rosy cockatoos, a fine Bengal tiger, a young lion, a family of gibbons with poor swinging space, several Indian otters and an excellent collection of francolins.

The labeling, in English and Urdu, was admirable, although there was sometimes a mixture of fable with fact. That on the solitary Bengal tiger will serve as a sample. It gave accurate, detailed data on range, habitat and the kinds of game most hunted. Then it went on to say that "the tiger will climb trees should need arise and will swim very well. Compelled to sit in the water in hot season. Chief enemies are wild dogs. Peacocks and jackals are the friends of tiger. It is said that the peacock takes out the unwanted flesh from its teeth. Undoubted is a noble animal, not cunning like leopard. Man as well as animals trust it. Hearing good. Eyesight keen. Actually less social than lion. Life span 30 years. Period of gestation 16 weeks. Two to five are born."

This type of label was on all the more spectacular species of birds, giving accounts of feeding habits, enemies, flight and sense organs with the facts dominantly correct. The labels were being read with interest by numerous visitors.

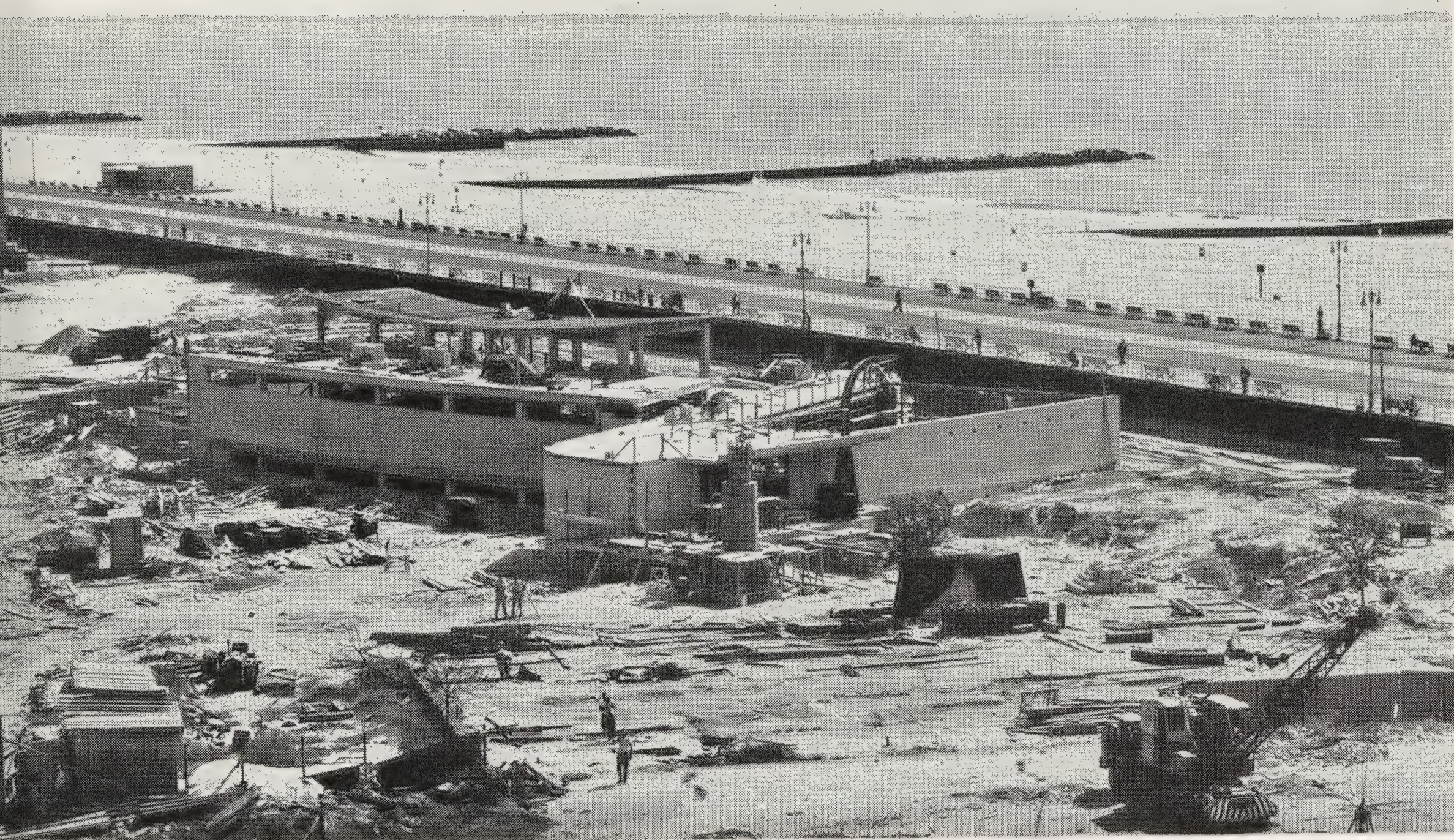
Cheerful Pakistani music came from the local Zoobar, where a sign offered "FREE WATER" — and nothing else — from a row of tin cups. Rubber-tired carts sold saffron-colored beans and nuts and edible strings of heaven-knows-what. A gilded ferris wheel with four cars, packed with women and children, was hand-pushed by two men, to delighted shrieks from the passengers. As in the Bronx, the largest gatherings were outside the primates' cages, particularly that of the gibbons. A large sign said, "If you have any questions at all about the care and feeding of

your pets and animals, our curator will be glad to help you." (Bronx Zoo, take notice!)

The aquarium was closed for the day, but the importance of its activities can be judged from a pamphlet in English of an exhibition of tropical fish only two months ago, when there were 625 exhibits and 64 gold cups awarded as prizes.

The real exhibit was not the animals — it was the people! From the porch of the aquarium's offices we watched the passing throngs. A simile would be the Bronx Zoo on a crowded Sunday with all the people in authentic, elaborate, brilliant fancy dress of a hundred different costumes, patterns and shades of color. Only these were not fancy dress, they were real. Karachi, as the capital of Pakistan, reaches far up into the lofty Hindu Kush Mountains and down into the hot plains. The costumes mirrored these diverse places. Although it was a blazing hot day, there were hillmen with fur-lined coats, turbans and native caps of dozens of patterns and hues; trousers tight-fitting and others composed of many yards of colored cloth. There were the baggy trousers of Baluchis, and the long, henna-dyed beards of the Sikhs. Little boys were clad in not a stitch while others wore elaborate gold-edged shirts. The garb of the veiled women beggared description, but ranged from jet black to gleaming white, and every glowing color between. Almost all the men had Aryan profiles.

Instead of conventional signs of "Keep Off the Grass" there should have been "Keep Off the People," for a goodly proportion of shaded grass or dirt was occupied. The sleepers seemed remarkably flat, as if burying beetles had been working on them for a time. Sooner or later every one shifted slightly, being edged along by the end man, whom the shifting sunlight had reached. He nudged or poked his neighbor and little by little the whole row was inched along. This pattern was interrupted by the impossibility of further shift, when the unfortunate human earth-worm would reluctantly creep along to find fresh shade. Here and there was a man who had brought his bedstead with him, with ropes instead of springs. Their elevation allowed another individual to lie beneath, so no change was wrought in the general assembly line. Crows hopped over and on the somnolent ones, searching for whatever a crow desires.



How's the New Aquarium Coming Along?

By CHRISTOPHER W. COATES

THE ANSWER to the questioning title of this report is: "Slowly but surely. And excitingly." Not quite as fast as we had hoped when we broke ground at Coney Island last October 24, but fast enough so that we can foresee an opening date *about* May 15 of this coming year.

We have every expectation of being able to move part of the administrative and operating staff into the new building before Christmas.

Tropical fish, and the big marine mammals that are to be featured in an outside pool, ought to arrive as early in the spring as the weather permits. That sort of thing moves rapidly, once the orders are given — with fishermen's luck.

The outfitting and equipping, testing and modifying of a great new institution dealing with

living organisms — even though Stage One now being built is only a \$1,500,000 segment of the final building — are time-consuming and exacting procedures. And some of them cannot be rushed.

By Christmas at the latest the Curator-Aquarist will move permanently from the Aquarium in the Zoological Park to the new building, together with a small crew of tankmen to begin setting up and conditioning the circulating water systems. The Assistant Curator and the Pathologist and the rest of the operating crew will remain at the Zoological Park to maintain the present collections until the new Aquarium is ready to receive them in late spring.

As the new Aquarium stands now, at the beginning of October, just short of twelve months since the ground-breaking, the greater part of the

wall structure is in place. Flooring and ceilings are yet to come. Boilers and electrical control panels have been delivered to the site and can be quickly installed. The intricate piping of hard rubber is being installed, from storage tanks and pumps to the tank sites. Garden contours are taking shape.

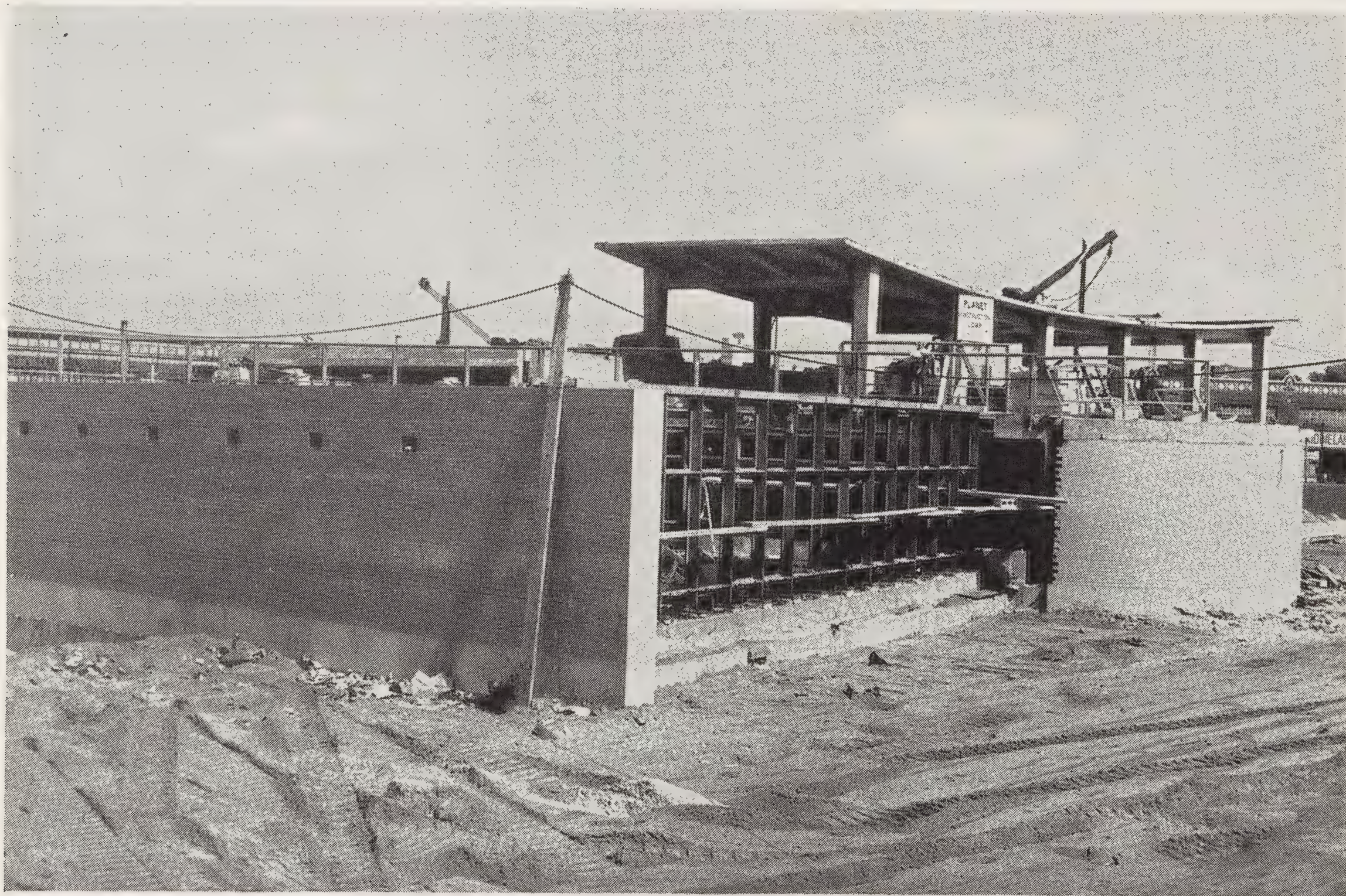
As the photographs (taken in mid-September) show, the 12-acre parkland devoted to the Aquarium is a confusing jumble of construction apparatus and materials. The confusion is deceptive; order and neatness can and will come out of it in short order, now that the major heavy construction is in place.

By Christmas or New Year's, the real fun begins. At that time we should be able to start the pumps and begin circulating fifty thousand gallons of sea water drawn from well-points long since buried offshore. This will flow into five pairs of great storage tanks where it will be gently heated (in some tanks) and the salinity increased to usable strength. Fresh water we expect to acquire by truck, probably from one of

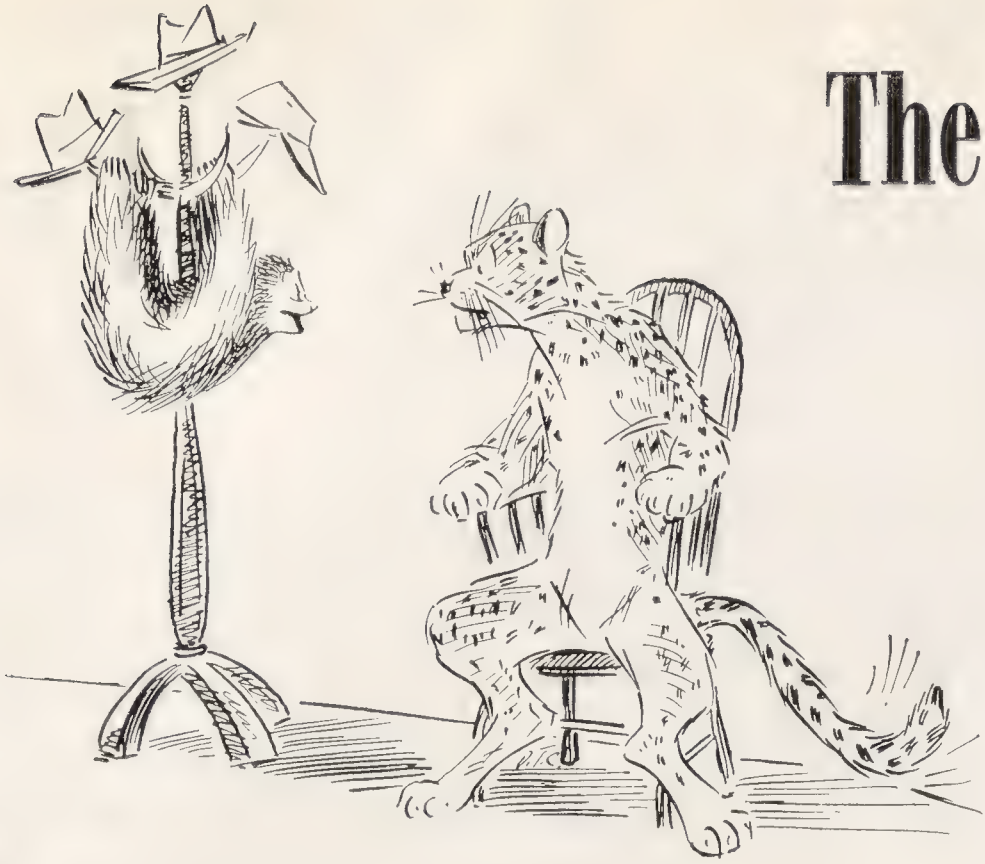
the city reservoirs, in case the normal flow of city water is not suitable.

It is not possible merely to fill the tanks and empty into them fish that have been freshly caught or even that have been on exhibition at the Zoological Park for a long time. The water must be thoroughly tested and its salinity or freshness ascertained over a period of weeks. Test fish will be introduced into the tanks at first, until conditions are exactly right for the introduction of the delicate and beautiful tropicals we expect to exhibit.

Arrangements for capturing and transporting fish and marine mammals have long since been made. It is hard to wait patiently for their arrival, now that we are so close to the finish. When the new Aquarium opens to the public — after a preview by members of the Zoological Society — next spring, it will be just a little less than fifteen years since the old Aquarium closed at the Battery. That we have not wasted our time in the meantime will, we hope, be demonstrated in the new Aquarium.



The new Aquarium from the Boardwalk at Coney Island. One of the outdoor pools is in the foreground. The open side, to be glassed, is 40 feet long and the blank wall with portholes is 60 feet long. The curved structure on the roof is the restaurant, which looks out over the ocean.



The Fable of the Sloth and the Cheetah

By DONALD T. CARLISLE

THERE WERE once a Sloth and a Cheetah who met by chance in the anteroom of the Zoo hospital waiting for a check-up.

"Aren't you the Cheetah I've heard about?" asked the Sloth. "Fastest thing afoot for the short haul? Something like that?"

"I *am* good in the dashes," beamed the Cheetah. "Anything up to the 440 hurdles — but tell me, you're the Sloth, are you not? The genius of slow and upside down motion?"

"Deliberate, my friend, merely deliberate," replied the Sloth, "and of course you know that if you look at things upside down you see them more freshly — image hits a new part of the retina, I believe. Far better than hasty decisions based on a quick, conventional peep."

The Cheetah by-passed this piece of anthropomorphic sophistry. "I tell you what I'll do," he said, "I'll lay you a small bet that by the time this magazine comes out again I shall have brought more members and prospects into the New York Zoological Society than you with all your careful deliberation and shrewd new viewpoint."

"Very well," said the Sloth. "Very well indeed. One of the Vets can hold the stakes, as I daresay we'll soon be moving to different parts of the Park."

Well, sir, at the end of the contest the Sloth and the Cheetah were tied.

Moral: Thoughtful and deliberate, or rash and hasty, you can be just as good a friend of the New York Zoological Society as the next member if you'll just send in as many prospects' names and addresses as you can think of. Blank for your convenience bound into this copy.

New Members of the New York Zoological Society

(Between July 1 and August 31, 1955)

Founder in Perpetuity

C. R. Vose

Life

Mrs. Peter Buba

Contributing

Edward Anthony

Harold L. Bache

Jesse D. Clarkson

Dr. Fulton Cutting

Joseph A. Davis, Jr.

Miss Della J. Evans

Mrs. W. Allston Flagg

John Goelet

Earle T. Holsapple

Kenneth A. Jones

Mrs. Arthur Kennedy

Mrs. James B. Liberman

Mrs. Shelton E. Martin

Mrs. Thora Ronalds McElroy

Maurice Meyer, Jr.

Edward Moose

Mrs. Charles W. Nichols, Jr.

Mrs. Chester T. Reed

Mrs. George E. Roosevelt

Alexander Schmidt

Mrs. Jay Stillman

William Stoddard

Robert E. Waterman

William P. Willetts

Annual

Bertram J. Black

Andrew Burr, Jr.

Mrs. A. H. Clayburgh

Peter Deger

Mrs. Margaret Devane

Owen Godwin

Paul C. Guthreil

George Habergritz

Seymour Horowitz

Leonard Kantor

Miss Elizabeth King

Mrs. Gilbert B. Lamb

Mrs. Clifford J. Nuhn

Albert J. Rosado

Robert L. Silver

Mrs. William R. K. Taylor

Louis C. Watjen

Georg Zappler

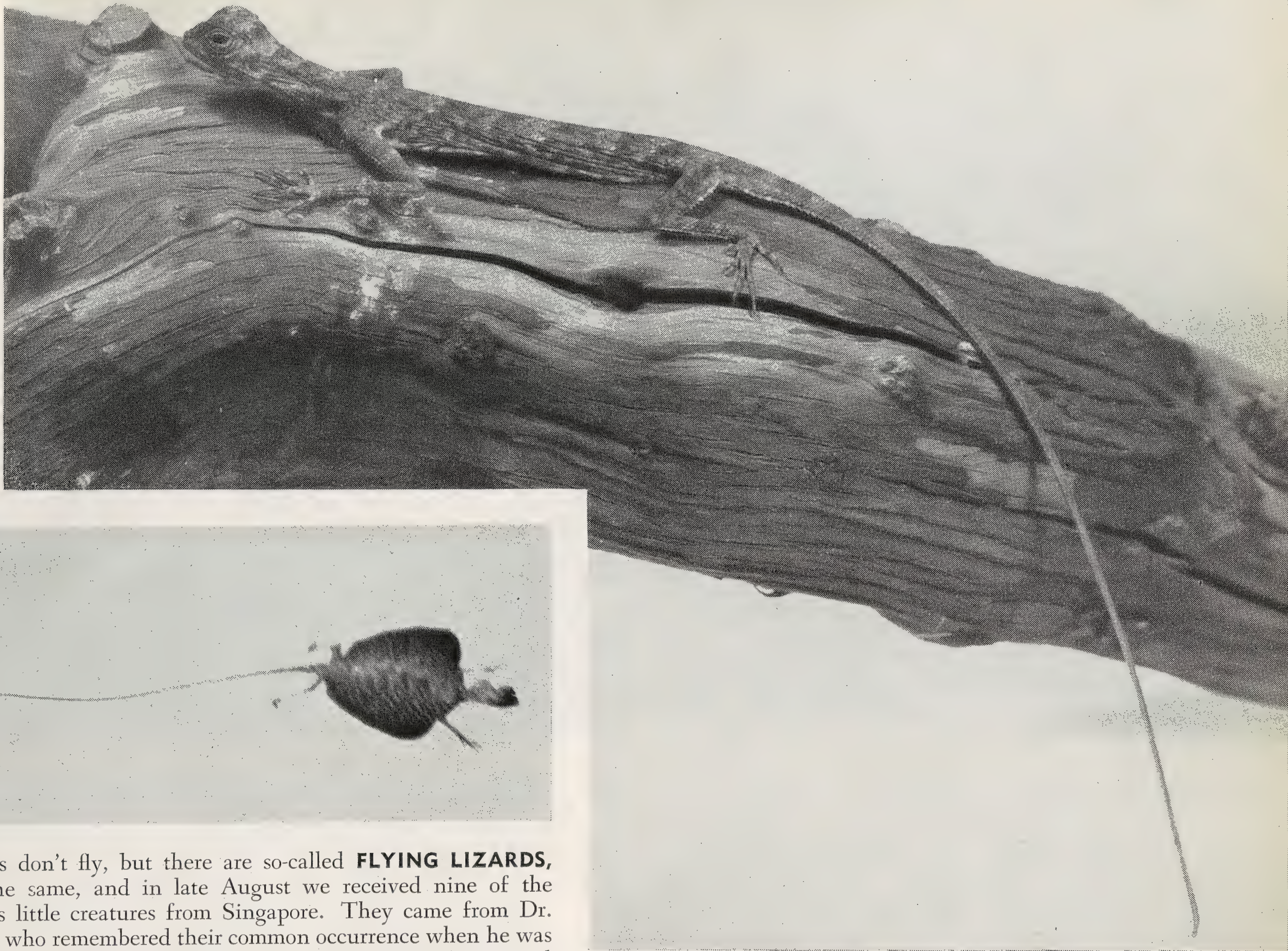
ZOO PICTURE PAGES

Photographs by SAM DUNTON



There is more than meets the eye in this photograph of **CANDY**, our young Asiatic Elephant. This little scene represents a Major Triumph of Man over Animal. Candy came to us from Siam three years ago last August 21 — a plump 752-pounder, about a year old, gentle, friendly . . . and stubborn. We expected to use her as a riding animal, to carry children on her back, as soon as she was old enough. Training was delayed until nearer riding age, but about a year ago housekeeping necessities compelled us to double up animals to make more space in the Elephant House, and Candy began to share a stall with Pinky, one of our African Elephants. They became warmly attached to each other and Candy has lost much of the docility and reliance on her keepers that we were counting on to make her training uneventful. Even to get on her back (while she munches extra rations of potatoes) is a kind of moral victory.





Lizards don't fly, but there are so-called **FLYING LIZARDS**, just the same, and in late August we received nine of the curious little creatures from Singapore. They came from Dr. Beebe, who remembered their common occurrence when he was working in that area almost half a century ago and promised that on his present return trip he would ship a boxful to our Reptile collection. Actually they are gliding lizards, but the name Flying Lizard is generally used. They hunt their food of insects on the branches of trees and have the ability to spread a wide flap of skin on either side of the body and glide outward and downward for distances of many feet. These pictures show one specimen (which was captured when it glided into Dr. Beebe's bathroom) at rest on the branch of a tree, and another "flying" downward from a table to the floor.



Never having had an **EMPEROR PENGUIN** before, we wondered how they went about getting into their swimming pool in the Penguin House. The pictures below make it clear. An Emperor simply makes a belly-whopper dive and the resulting splash generally blanks out the glass front of the pool for several minutes. Our two Emperors came on April 29 and weighed 52 and 63 pounds respectively. On a diet that has varied between 4 and 6 pounds of mackerel a day they have picked up weight astonishingly and now weigh 86 and 80 pounds respectively. They still have to be fed by hand. At first they were hesitant about going into the pool and a quick dip, in and out, was all they permitted themselves. Now they are diving and swimming in the pool several times each day.





The luck of our Reptile Department is rapidly taking on aspects of the phenomenal. Among the visitors who daily come to the Administration Building and ask for various curators was a young man named Peter Beard, of New York City, who said he had a snake he would like to present. Dr. Oliver took one look and exclaimed: "Langaha! How did you get it?" It seems that Mr. Beard has been traveling in Africa and Madagascar with a professional photographer and on the side pursuing his hobby of herpetology. While chasing a lizard down a jungle trail in Madagascar, he came upon a small, gray

snake in the path, and scooped it up. Close examination showed that it had a very curious serrated structure as a nose, and Mr. Beard had never encountered such a snake before. He took it to the Museum of the Scientific Mission in Tananarive, and after much searching in reference books someone identified it as one of the four species of **LANGAHA** — a snake that is excessively rare. Nothing at all is known about its habits in the wild. Its mottled gray coloration is excellent camouflage against bark, and its peculiarly developed nose may be further camouflage when it is stalking its prey.

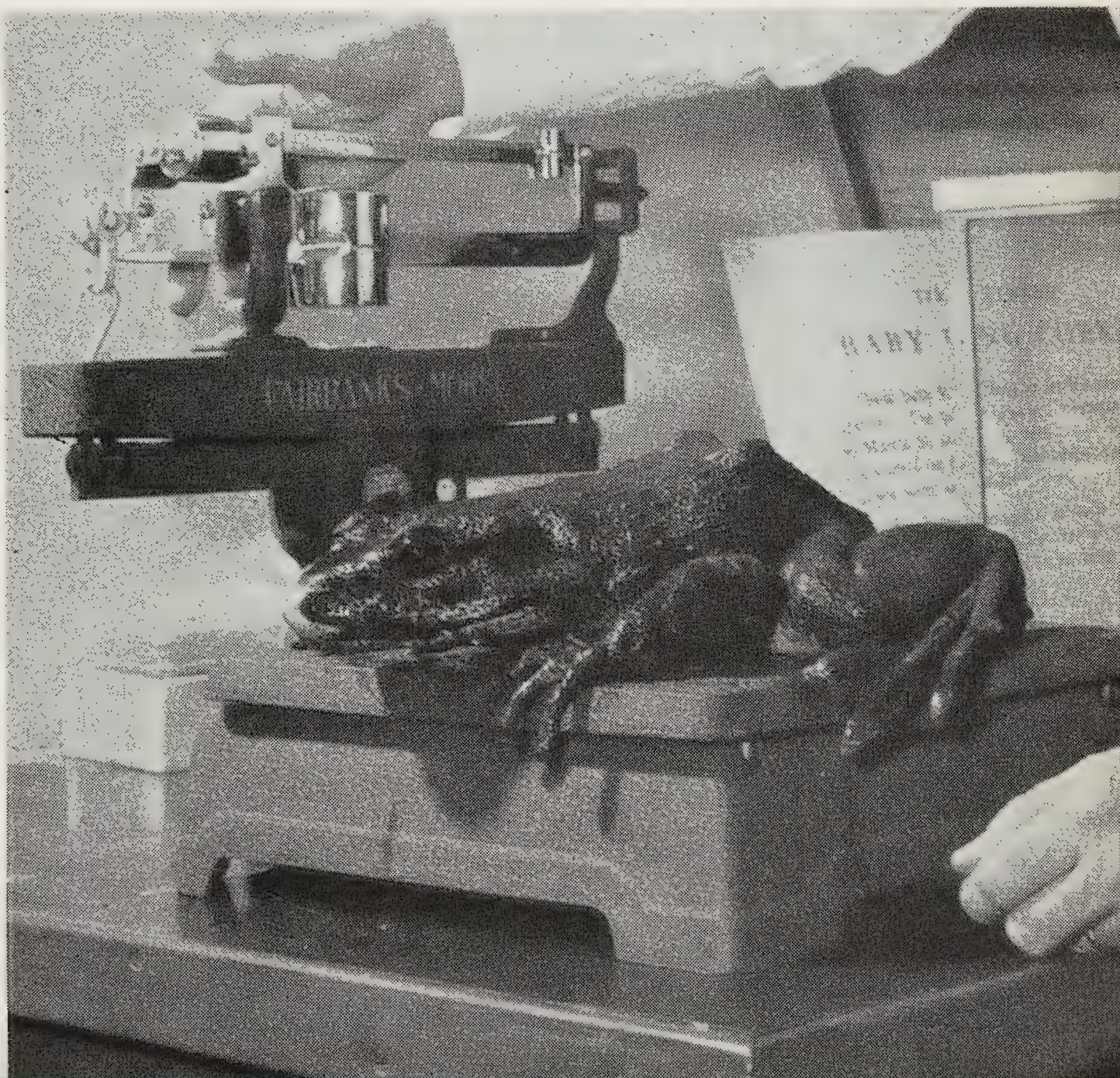
Most **MOUSE OPOSSUMS** live out their natural lives in the tropical American forests, hunting by night for moths, beetles and other insects and probably quite frequently venturing into banana plantations to raid the stems of ripening fruit. Inevitably a good many of them come north in banana shipments and are discovered when they reach the retail outlets. This mother and two babies (now on exhibition in the Small Mammal House) escaped detection in the banana warehouse and a retail grocery and were not discovered until the stripped stalk of their banana home was on its way to a city dump. The Sanitation Department truck driver carried the family to a bar as a great curiosity. Eventually a police officer took over and transferred the waifs to the A.S.P.C.A. refuge, which in turn passed little *Marmosa mexicana* on to us. Practically all our Mouse Opossums in recent years have come to us through some such agency, and we rely on these "banana bonanzas" just as we rely on the fall migration for our Ruby-throated Hummingbirds.



Fifty-eight years ago the largest and most massive of all the elk in the United States was named scientifically as *Cervus canadensis roosevelti* in honor of Theodore Roosevelt, at that time Assistant Secretary of the Navy. **ROOSEVELT ELK** are found only in a few restricted areas on the west coast of America, and in California they exist only in the Madison Grant Forest, a 1,600-acre redwood tract in Humboldt County. Now we have received a 90-pound female calf, the first example of this subspecies we have ever exhibited. It came to us through the efforts of DeForest Grant, a trustee of the Zoological Society, and the agency of the California Division of Beaches and Parks and the Department of Fish and Game. At next spring's calving we hope to get a bull calf and eventually to establish a herd in the Zoological Park. The young female is happily adjusted to life in the large White-tail Deer enclosure.



One Friday morning in late August our Curator of Reptiles spent fifteen minutes with a missionary telling him how to pack and ship a **GIANT FROG** in case he ever managed to collect one in the Cameroons or French West Africa. "It's a long shot, but he *might* run across that frog and I'd surely like to have one," was Curator Oliver's comment afterward. On the following Monday morning, by pure coincidence, the Giant Frog *did* turn up in New York; an animal importer telephoned and offered us the second specimen ever exhibited in the United States. Not only is it the largest frog in the world; it is one of the rarest. Ours weighed 5 pounds and was 26 inches long. It was so emaciated that we had few hopes of keeping it alive and it did, indeed, die five days later. Some day, perhaps through the missionary, we will receive a healthier specimen.





The **RIBBON-TAILED BIRD OF PARADISE** is a great and beautiful rarity, never more impressive than when its central pair of tail feathers is at its full length of 30 inches and is still black-tipped. Usually within a week of full development, the bird somehow manages to break off the black terminal area — as it did after this picture was made.





In the last issue of this magazine we announced with an ill-concealed pride that one of our **KING PENGUINS** was incubating an egg and that it should hatch around August 15. This is the sad sequel. When nothing had happened by August 17, we took the egg away from the incubating bird (Left) and examined it. It was cracked —

badly cracked. A minute and careful examination indicated that the egg had been fertile, all right, and that the embryo had started to develop. The shell was cracked accidentally probably within the first two weeks. The picture at the left shows how a fold of skin envelopes and covers the egg, which is carried on the penguin's feet for about 52 days.



Feeding time in the Animal Nursery is a catch-as-catch-can proposition. The **CHINESE WATER DEER** at the extreme left insists on taking its bottle lying in Keeper Helen Martini's lap; the **ARABIAN GAZELLE** in the center is equally insistent on taking its bottle standing up at feeding time. Both the young animals are semi-orphans being reared in the Nursery because at birth they were too weak to remain with their own mothers. The picture below shows Mrs. Martini's technique for getting the Gazelle to stand still for its daily grooming. She holds a bottle of milk just out of reach and it waits expectantly for its reward.





(*Photograph by Margaret Hogaboom*)

The Riddle of the Ridley

By ARCHIE CARR

Professor of Biology, University of Florida

Dr. Archie Carr is one of the foremost turtle experts of the United States and for eighteen years he has puzzled over the genesis of the sea turtle commonly known as the Ridley. Some of his herpetological associates, indeed, aver that the Ridley has become an obsession with him, and delight in proposing ingenious explanations of the origin of the creature. Nothing, however, equals the ingenuity of the Ridley itself, for its method of generation and even its place of origin have eluded not only Dr. Carr for eighteen years, but professional turtle hunters for far longer than that.

Dr. Carr is Professor of Biology at the University of Florida. "The Riddle of the Ridley" is a condensed chapter from his forthcoming book, "The Windward Road," to be published by Knopf early in 1956.¹

¹ Reprinted from *THE WINDWARD ROAD* by Archie Carr by permission of Alfred A. Knopf, Inc. Copyright 1955 by Archie Carr.

THE TWELVE-FOOT POLE flew a high arc and struck true over the skidding shadow. It plunged quarter-down and stopped short against the hard shell of the turtle. Then it fell free and floated to the top.

"Missed him," I said. I should have known better. It was Jonah Thompson who threw the iron.

But how does anyone hit a target like that? The bow of the little launch was bucking and shying in a cross-channel chop. A gusty breeze kept throwing the surface of the bay into crowds of tight wrinkles that raced by and shot back the light in confused reflections. The water was milky white to start with, and the turtle was thirty feet out and a yard down and dodging like a rabbit. It was like trying to hit a scared pig from the bed of a truck lurching across a plowed field. Only the pig would be out in plain view, while the turtle was a dim blur in the water.

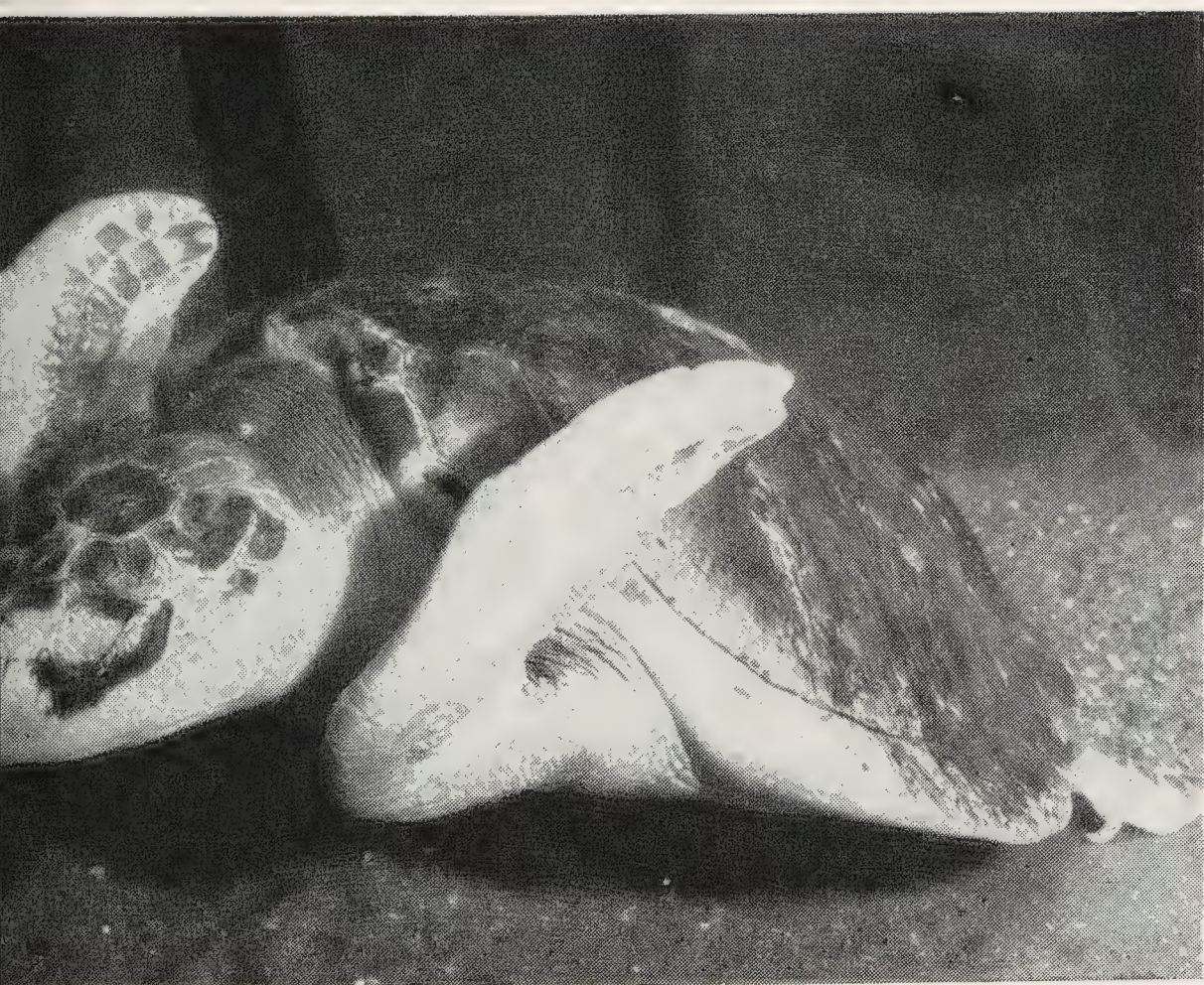
"He's carrying the iron," Jonah said. Then I saw the line snaking out of the bucket in the bow.

"How do you do it?" I said.

"I'm sixty-five and I started early. It's worse with green turtles; they run like a seagull. This here's a ridley."

He clawed in the pole with a boat hook. He took up the smoothly paying line and slowly closed both hands on it. The tension pulled us around a few points, and then a flipper broke water fifty feet out in front. Very carefully Jonah began to take in line, and the boat and the surfaced turtle drew together. When the gap closed he handed the tight line to his boy and deftly dropped a loop of rope over one of the flailing

ridleys ought to like this beach at Tortuguero on the Caribbean coast of Costa Rica, but they don't nest there. (Below) An Atlantic Ridley, caught in the Hudson, sleeps on the bottom of its aquarium.



flippers. Then he heaved, and the turtle slid over the gunwale and fell back-down on deck, where it scraped and thrashed for purchase on the smooth planks.

"Stay clear of him," Jonah said. "He's mad. Ridleys is always mad."

I poked a rope end at the turtle's face. It seized the knot and crunched and then flew into a long frenzy of flopping and pounding about the deck.

"You can't keep a ridley on its back. Only a few hours. They're crazy. They break their hearts."

That was how I got to know the Atlantic Rid-

ley. That was how the great ridley mystery began for me.

It is the sea that holds the great mysteries. There is still much to be learned in the land, to be sure, but it is the third dimension of the oceans that hides the answers to broad elemental problems of natural history. Somewhere out there young salmon lose themselves, and the Pribilof seals go there when they leave the rocks where they were born. Through chance concordance of cryptic forces, the Red Tide brews up and sporadically drifts in to the rich littoral of Florida, killing thousands of fishes, sending the tourists scurrying to flee the stink, and then sweeping away again, unchecked and uncomprehended. As long as man has had the wit to wonder, he must have puzzled over the new eels in his pasture pond; and being told they come from the sea where their parents went to spawn them is as preposterous as some theory of astrophysics. When J. L. B. Smith found a coelacanth fish fifteen years ago, it was a living fossil, as stirring a discovery to a biologist, and quite as great a probing of the past, as finding a dinosaur would be. Who can trace the way of the great blue marlin or of Rhineodon, the whale shark, or tell anything worth hearing about the oarfish or the giant squid, or even say for sure where the homely mullet spawns its millions or where the gleaming hordes of tarpon come from?

And who can tell what the ridley is?

It was eighteen years ago when Jonah Thompson pulled in that first ridley out at Sand Key in Florida Bay. I was there because of a letter from my friend Stew Springer, who is a gifted naturalist, versed in all sorts of seacraft. He was running a shark fishery at Islamorada on the upper Florida Keys at the time. He wrote to me to complain about a kind of turtle his fishermen brought in for shark bait. It was an evil-natured turtle, he said, flat and gray, with a big head and short, broad shell. Unlike the docile greens, which lie for weeks back-down on a ship's deck, or the formidable but philosophic loggerheads, this species made an unrestful, even dangerous, boatfellow. It snapped and fought, Stew said, from the moment it fell over the gunwhale, biting the air and slapping its feet till it burned itself out from rage and frustration. The people on the keys called it ridley, and Stew said he could not even find the

name — much less any information on it — in any of the books.

Neither could I. From the description I decided that Stew must be talking about a species that was first described some sixty years ago as *Lepidochelys kempi*, the specific name being taken from that of Richard Kemp of Key West, who sent the type specimen to Samuel Garman at the Museum of Comparative Zoology at Harvard. Practically nothing was known about the natural history of Kemp's turtle. Most people were unable to distinguish it from the loggerhead, and many even doubted that there really was such a thing. A scattering of herpetologists had published records of its occurrence or comments on its osteology, but the great majority of reptile students had never even seen one and the general attitude was that Kemp's turtle was a somehow inferior, if not altogether spurious form, not worthy of scholarly sweat. But Stew had a different opinion, and I had great respect for his perspicacity; I decided to go down and see his hotheaded sea turtle in the flesh. I suppose that one reason for my steadfast affection for ridleys is the memory of that trip to the Keys.

* * *

Jonah Thompson could handle an iron better than any man of any color I ever saw. He knew weather and water and fish and, what was most important of all, he knew turtles.

And so, when he contemplated the irate ridley he had just pulled up on deck and said: "Some say these ridleys is crossbreeds," I took notice and urged him on.

"We don't know where they lay," he said. "All the rest come up on the beaches one time or other, but you never see the ridleys there. We all say they are made when a loggerhead pairs with a green."

It bothered me that the ridley should be such a distinctive and original-looking creature, with his traits his own and nothing about him that seemed intermediate between the other species. A mule is clearly a mixture of the ass that sired him and the mare that bore him, but a ridley is his own kind of animal. I nodded over Jonah Thompson's theory, but I resolved then to get the straight of it somehow.

As I said, that was a long time ago, and I have made very little progress. Indeed, the ridley mys-

tery has grown rather than shrunk, and I am farther from a solution than I seemed then. The answer is so elusive that I have come to regard the ridley as the most mysterious air-breathing animal in North America.

First of all, there is the unimportant but vexing question of the creature's name. Ridley! What kind of name is it anyway, and where did it come from? I've traced it all along the coast from Fernandina to Key West and out to Pensacola and people only look vague or grieved when I ask about the name. To most people it's like asking why they call a mackerel a mackerel, or a dog a dog. Once in a while I run into somebody who knows the ridley as "mulatto" or "bastard" or "mule-turtle," in reference to its supposed hybrid origin; but most places the name is ridley, and not a soul knows why. Maybe one out of a couple of dozen fishermen pronounce it "ridler"; and it may be that this form represents an earlier stage in the etymology of the term, but it seems impossible to confirm this. Anyway, compared to other things we don't know about the ridley, the question of its name is a bagatelle; and our ignorance here is exasperating, but not necessarily demoralizing.

A more unsettling eccentricity is the animal's range — the territory in which it has been found to occur. All the other sea turtles — trunkback, green, loggerhead, and hawksbill — occupy pretty much the same area, each being found in the Atlantic, the Caribbean, the Pacific, and the Indian Ocean. Moreover, while the representative of each of these species in the Indo-Pacific is isolated by land or by great expanses of cold water from its counterpart in the Atlantic-Caribbean, the populations are remarkably similar. In fact, if you go to Colón, on the Caribbean side of Panama, and catch a green turtle, haul him across the Isthmus to Panama City, and compare him point for point with a green from the Pacific, you have to look very close indeed to see any difference at all. It is the same with a great number of other marine animals, both vertebrate and invertebrate, on the two sides of the Isthmus: they are separated by thousands of miles of alien territory but they nevertheless show very little of the divergence that such isolation usually brings. This is especially striking when you consider that the emergence of the isthmus that cut off the

Caribbean animals from their eastern Pacific kin took place at least thirty million years ago.

The ridley partly fits this pattern; that is, there is an Atlantic ridley and a very similar one in the eastern Pacific. They are numerous only in the warmer parts of their ranges, and are apparently not in contact around the tips of either Cape Horn or the Cape of Good Hope, except perhaps as occasional, current-borne flotsam. But here the orthodoxy of the ridley stops. For some utterly unaccountable reason it is not found in the Bahamas or Bermuda, where all the rest are, or have been, abundant; and most peculiar of all, it is absent from the Caribbean.

It is not a simple matter to get a clear picture of the range of the ridley. You don't just go out and catch sea turtles on an afternoon collecting trip, and there are no really good sea-turtle collections in any of the world's museums.

Counting specimens I have begged or bought from fishermen or seen being butchered in fish houses, and the collections of the Museum of Comparative Zoology, the American Museum of Natural History, and the British Museum, I have managed to look at about a hundred ridleys in eighteen years. Add to what these show the small amount of information that has been published and the carefully sifted oral reports of fishermen, and there is still not a great deal to work with. But it is enough to give the outlines of the ridley story, and to show that it is a strange one.

There are two centers of abundance of ridleys: the Gulf coast of Florida from the Suwannee Delta to Florida Bay and the east coast from about St. Augustine to Melbourne. On the east coast, ridleys are best known by trawlers who work some distance off shore, perhaps indicating that even this far south the animals are being swept northward by the Florida Current — the headwaters of the Gulf Stream. I know a fisherman at Canaveral who claims to have caught a thousand ridleys during twenty years of fishing there. On the Gulf coast they are taken along with the green turtles that support the small turtle fisheries there, and are frequently sold with the greens to buyers who never know the difference. They are caught in nets set across small channels among the flats, and like the young greens, they appear to be at home there. A single setting of a net will sometimes yield two or three

of each species, while loggerheads are almost never taken.

Outside of Florida, ridleys occur all along the Gulf coast to Texas. At the Mexican border our information peters out; nobody knows what happens to the range of the ridley from there on. The few published articles on Mexican sea turtles mention the other four kinds, but not the ridley. On the Atlantic coast it seems to me that the distribution of the ridley is no true "range" in the zoo-geographic sense — an expanse of territory that an animal occupies or voluntarily moves across — but is a one-way, passive dispersal by the Florida Current and the Gulf Stream; an exodus with no return. Expatriate ridleys drift with the current with little more control over their ultimate fate than the plankton there. The ones near the edges may be able to move out into the coastal waters, reach shore and live there more or less conveniently; but those deep within the stream go on. Where the Florida Current picks up its supply of ridley is not known, for reasons that I shall reveal presently; but there can be little doubt that it is the northward sweep of the current just off the eastern shore that accounts for the occurrence in North Carolina and New York Harbor and Martha's Vineyard. Little as we know about ridleys, we can be sure they are not born in those places. They are carried there.

And they do not stop in Massachusetts. The Gulf Stream goes on, and they go with it. How they are amusing themselves all this time is hard to say, but they ride the great global drift out into the cold North Atlantic, where it travels its new easterly course at a reduced speed but glides on over the tail of the Grand Banks, pushes aside the arctic icebergs, and splits at last against western Europe, making it barely possible for human beings to stand the English climate, and stranding ridleys on such shores as Ireland, Cornwall, the Scilly Isles, southern France, and the Azores.

The range of the ridley, thus, is not an expanse of ocean or a strip of shore. Mostly it is the Gulf Stream. Ridleys are part of a vast planetary swirl that starts when the equatorial current and the easterly trades push water through the Yucatán Channel and pile it up in the Gulf of Mexico. The surface there rises six to eighteen inches higher than the Atlantic level and breeds the head that drives warm water clockwise around

the eastern Gulf and nozzles it out through the Straits of Florida as the Florida Current. This soon meets the Antilles Current, and the two now form the "Gulf Stream" in the new strict sense, and this moves northward with an initial speed of about three knots. Somewhere along the line ridleys are fed into this system, to drift downstream to England through three thousand slow miles.

It would be wrong to give the impression that ridleys are of common occurrence in Europe. I recently looked at six English ridleys in the collection of the British Museum, which is the best sea-turtle collection in the world, and those six represent all the European specimens in that museum. They may represent half of all the English ridleys that have fallen into the hands of naturalists. Ridleys, and sea turtles of all kinds, are very rare in European waters. But even so, I wonder how many ridleys had to begin the voyage in America for each of the six that lodged at last in the British Museum!

Two features of the British waifs must be of some sort of significance in the cryptic life history of the animal: they are all small — none over eight inches long and one only four — and they have all washed up during the months from October to December. I suppose the small size merely means that baby turtles are swept away more easily than big ones; but the meaning of the seasonal occurrence of the strandings is unexplained.

If we suppose that the point of injection of ridleys into the Gulf Stream system is somewhere about the tip of the Florida peninsula — and the slim evidence that seems to support this assumption will come out shortly — then the trip to Europe might take as much as a year or even more. It seems unlikely that even a turtle could survive this period with no food at all. So, even though the ridley is characteristically a bottom feeder — a crusher of crabs and mollusks — we must conclude that it finds some sort of fare in the Gulf Stream.

It must have occurred to you some time back that the sensible way to go about finding out where ridleys get into the Gulf Stream would be to locate the beaches where the young hatch out. That makes sense, certainly. The only trouble is, the beaches can't be found.

In fact, I can't find any evidence that ridleys breed at all; by any of the accepted methods. I am still just about where Jonah Thompson's folk theory left me. As far as I can determine, nobody ever saw a pair of ridleys courting or copulating. People are constantly catching and butchering sea turtles and looking about inside them for eggs, but no female ridley has ever turned up pregnant — not even with the bead-like, yellow eggs that other female turtles carry for most of every year. No ridley has ever been seen on a nesting beach, and no hatchling has been found. The smallest ridley known is a four-inch specimen that washed up in England. This one was at least several months old. A newly hatched one should be little more than an inch long, because the loggerhead, a turtle two or three times the size of the ridley at maturity, is only slightly more than an inch long at birth. Not only that, all hatchling turtles have a soft umbilical scar, marking the place where they were attached to the yolk in the egg; and at the tip of the snout there is a sharp spine called an egg tooth that the little turtle uses in freeing itself from the shell. Turtles retain these signs of infancy for several weeks after hatching. No little ridley has ever been seen with them.

When Kemp sent the ridley to Harvard in 1880 he said: "We know that they come out on the beach to lay in the months of December, January and February, but cannot tell how often or how many eggs." I don't think he knew any such thing. When I made my first visit to Springer's shark camp on the keys, I went armed with this observation; and since it seemed a bizarre reversal of the usual nesting schedule, I went to some effort to authenticate it. I had no success at all. I talked with people who knew ridleys all the way from Homestead to Key West and none had ever heard of a turtle nesting in the winter-time or had seen a ridley nest or egg or baby at any time. Since then I have heard the same story from something over 160 of the most knowledgeable fishermen I could find between Cape Hatteras and the mouth of the Mississippi. I have dissected every mature ridley I could get and have cross-questioned the men who slaughter turtles for the market, and I have begun to feel the real weight of the enigma.

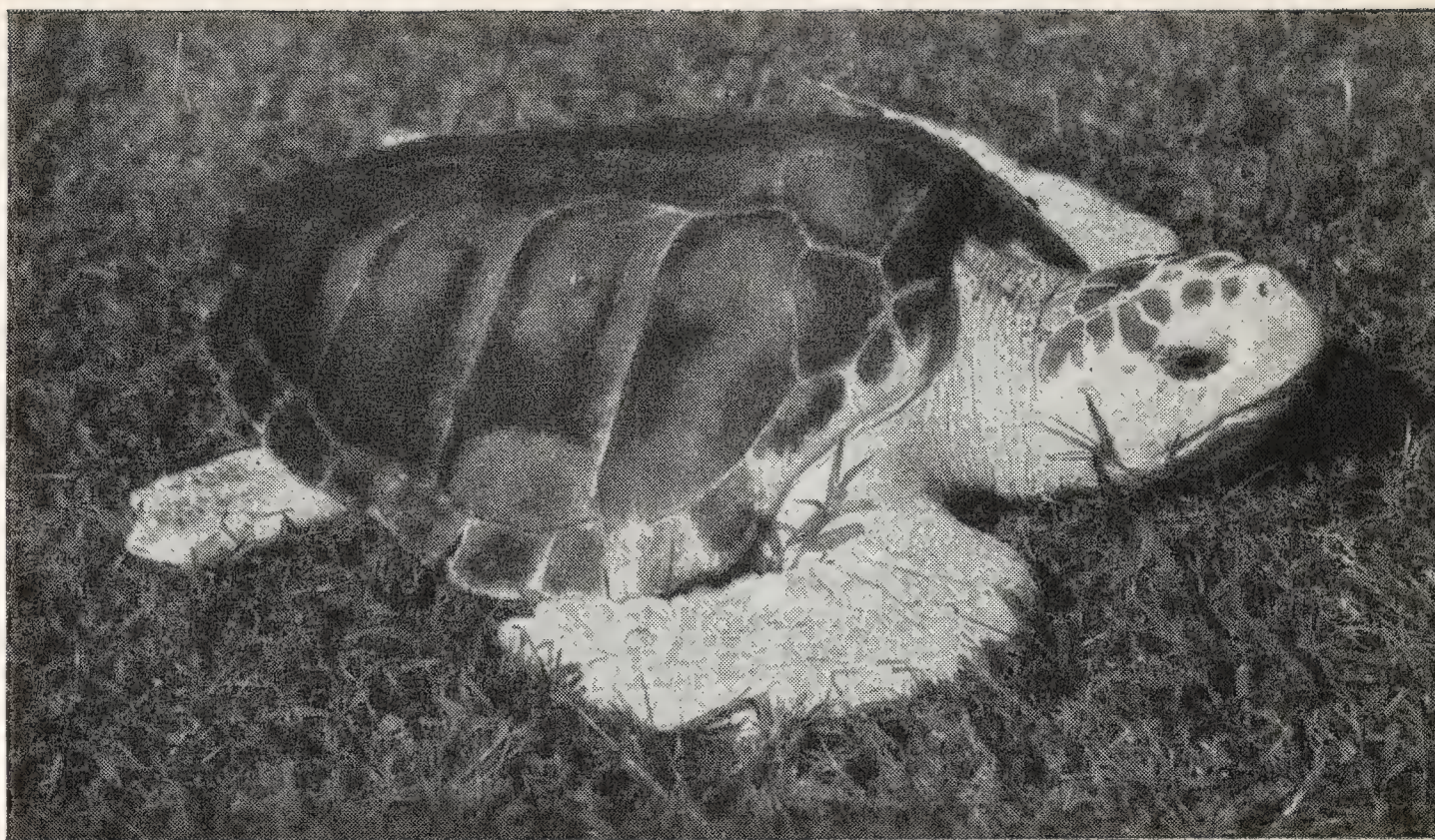
When the turtlers and fishermen are pressed to

account for the facts of the case, they tell three different stories. Most of them agree with Jonah Thompson that the creature does no breeding on its own but is produced when two other species hybridize. The comment of an old pod at St. Lucie Inlet was the sort of thing you hear:

"This yer ridley don't raise. He's a bastard, a crossbreed you get when a loggerhead mounts a green — and a loggerhead will mount anything down to a stick of wood when he's in season. This yer ridley don't have no young 'uns. He's at the end of the line, like a mule."

A minority among the people I talk to say that ridleys breed all right — bound to; everything does; but they do it somewhere 'way off, outside our field of responsibility. On some remote shore of the Caribbean, maybe, where they have yet to be observed by sapient man. Sapient gringo, anyway.

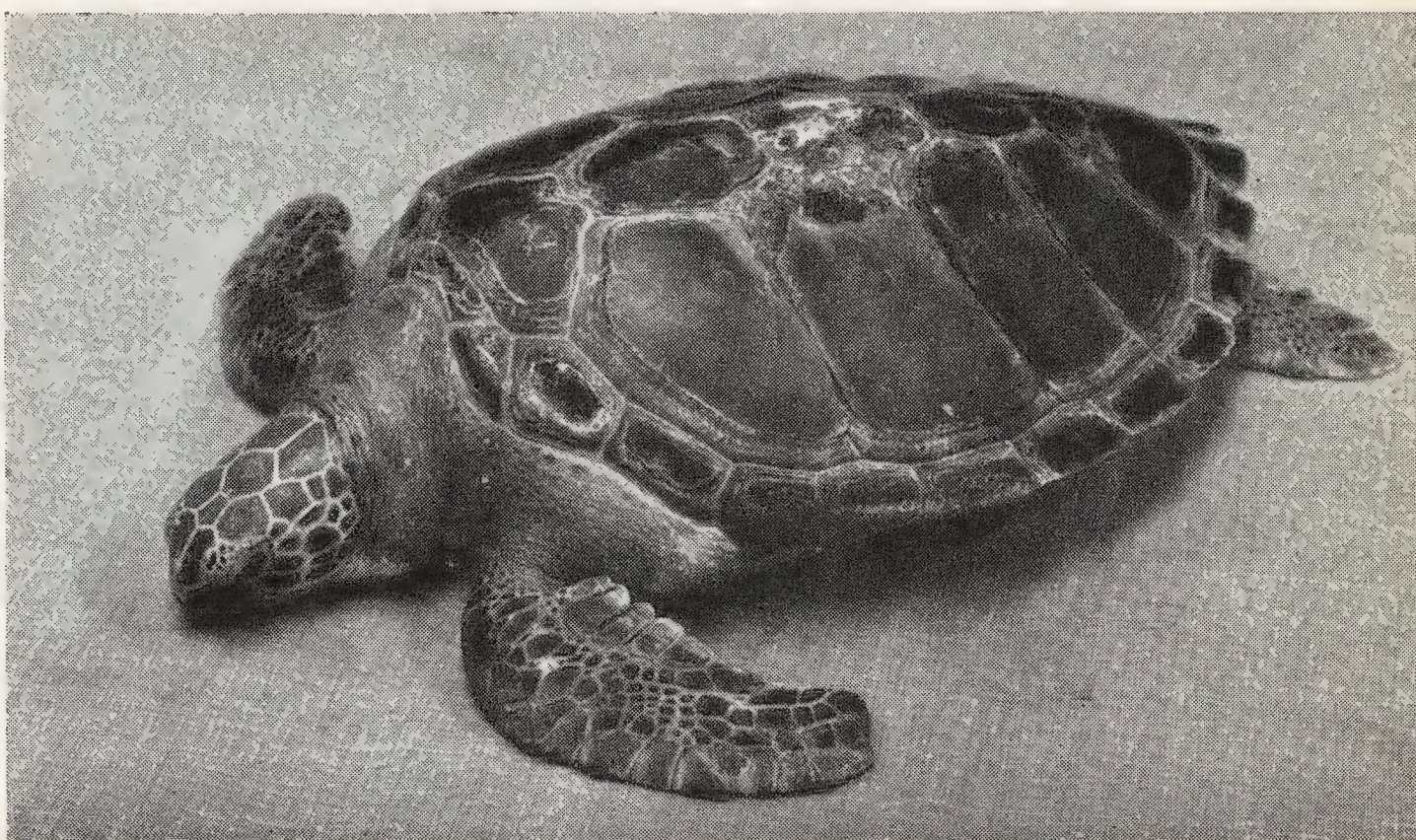
This kind of talk used to reassure me. It was something to fall back on when the thought of a parentless, childless animal weighed me down. It was no disgrace not knowing where the brute



ATLANTIC LOGGERHEAD TURTLE

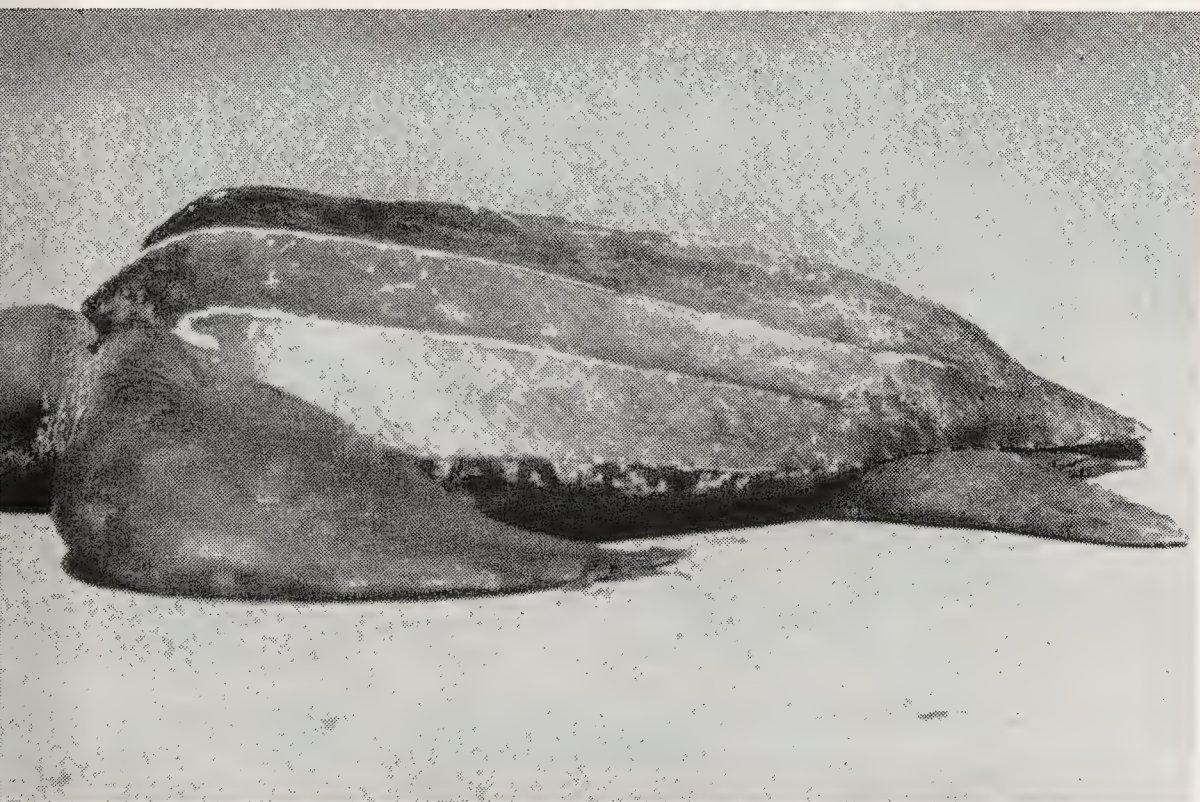
Caretta caretta caretta

(Photograph from Zoological Society of Philadelphia)



ATLANTIC GREEN TURTLE

Chelonia mydas mydas

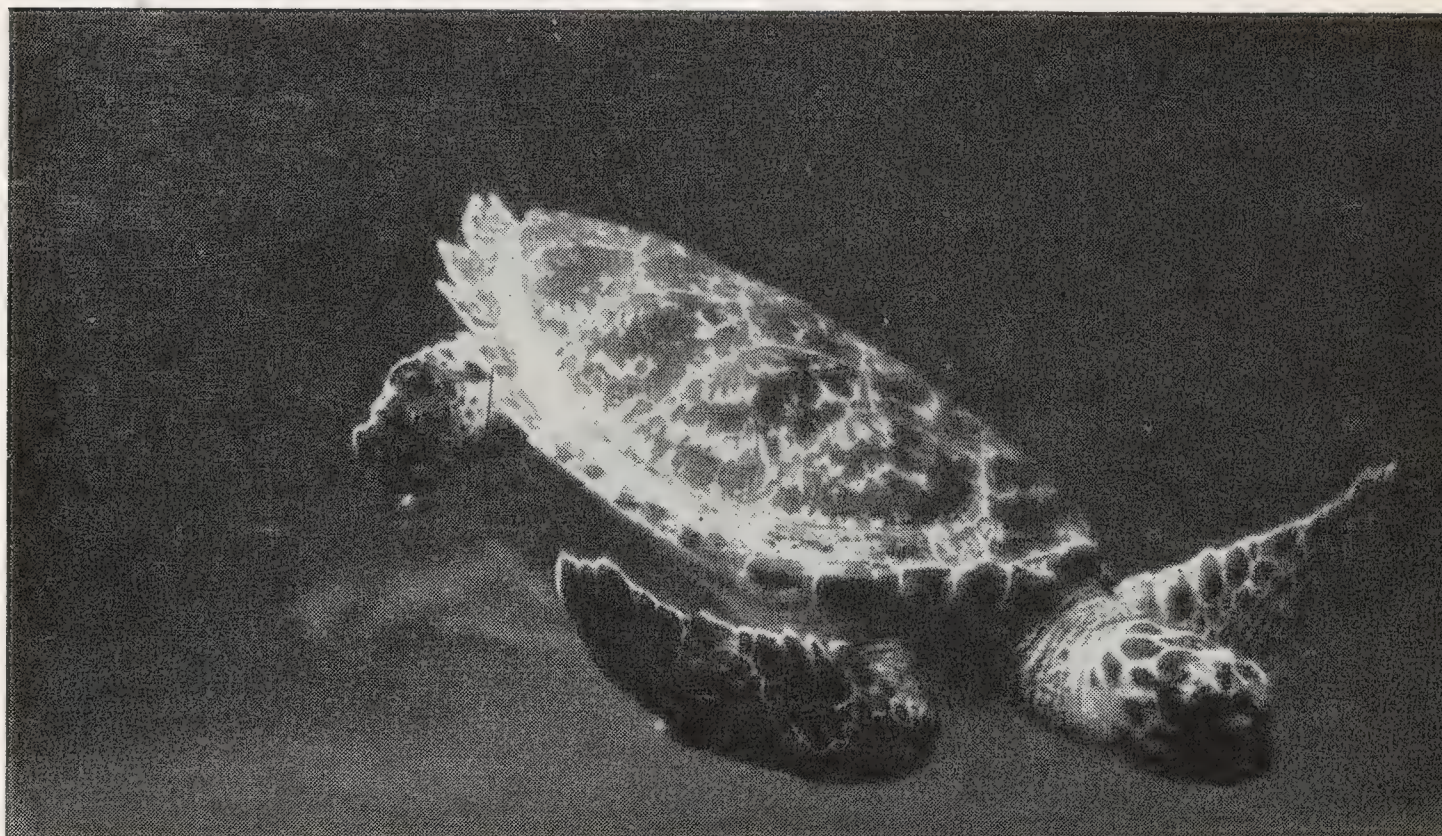
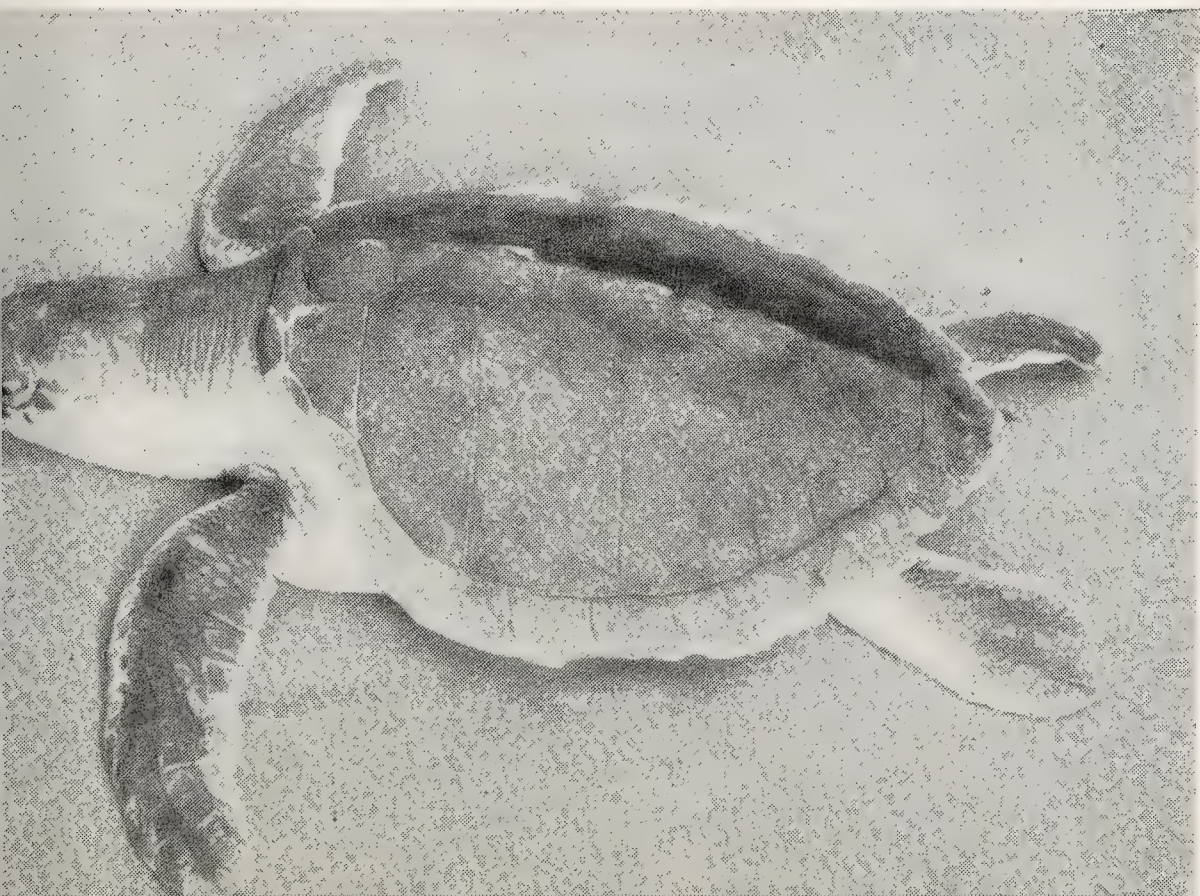


ATLANTIC LEATHERBACK TURTLE

Dermochelys coriacea coriacea

ATLANTIC RIDLEY TURTLE

Lepidochelys olivacea kemp



ATLANTIC HAWKSBILL TURTLE

Eretmochelys imbricata imbricata

bred if it happened in some far corner of the Caribbean. The Caribbean is a big place, and I knew its shore only in a couple of spots. Ridleys were unknown in those spots, but this proved nothing at all.

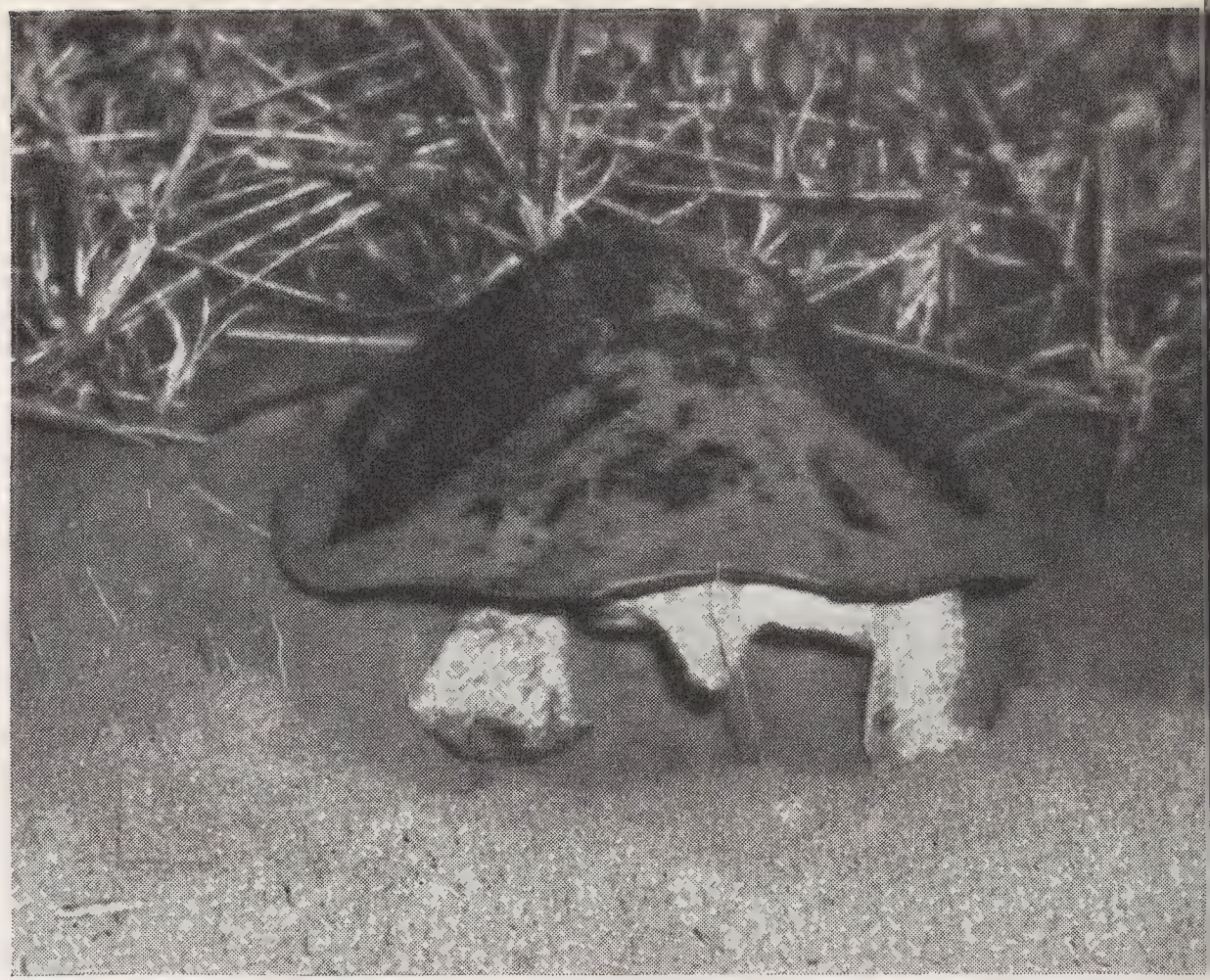
Imagine my state of mind, then, when I had completed a carefully spaced series of visits all the way around the Caribbean and had found no sign either of ridleys or of people who knew them, anywhere in a dozen countries and islands. I went out with turtle-hunters and looked at turtles in crawls, and at shells on trash heaps, and at stuffed turtles on museum shelves. I walked some of the finest turtle beaches in the hemisphere. I saw a lot of things, but no ridleys. Everywhere I went the people knew four kinds of sea turtles, and none of them was the ridley.

This was a body blow. It threw the whole problem back into the Gulf of Mexico — into my lap. My ignorance became embarrassing again.

The third explanation I commonly hear is the opinion of a still smaller group that the ridley is out there each June laying, along with the other species, in the same places and at the same time. I have heard this seriously proposed by responsible parties five times. That is, five times people named definite stretches of beach on which they believed ridleys laid. Four of these stories fizzled out under cross-questioning, proving to have been based either on pure hearsay or on erroneous identification of the turtle involved. In one case only, the battering system of interrogation I have developed through the years was unable to find the weakness in a man's claim that he had seen a ridley lay on a certain beach; and we parted at deadlock — he clinging to his memory of one lone ridley in moonlight twenty-five years old, and I sure without any proof at all that he was off his rocker.

I will admit that there is a slight possibility that each June ridleys lumber up at first full moon and dig their nests on the shoulders of State Road A1A, like the loggerheads; but I rest no easier for it.

That, then, is the riddle of the ridley: a big, edible shore-water beast, abundant and well known to everybody along the east-Gulf littoral and around the tip of Florida, is swept up the Atlantic coast by the Florida Current and the Gulf Stream, through some whimsey never



▲ **A Pacific Ridley lays eggs—these photographs are proof of it. In the picture at the right, about half a clutch has been laid, 1 to 4 eggs at a time**

crossing to the eastern side of the current and being unknown in the Bahamas and in Bermuda. The drifting migrants trickle out of the stream into coastal waters as far north as Massachusetts, straggle across to Europe, and very rarely stick with the deflected drift as far as the Azores and probably farther. Nowhere in this vast territory has any hint of reproductive activity been seen.

What do you make of it? I used to think the solution would one day fall into my lap, but I believe this no longer. It will have to be worked for, and the campaign will require drive and imagination and patience. It will probably resolve itself into a systematic ransacking of ideas and places on a purely trial-and-error basis. It will not be settled on week-end field trips, and there is nothing to take into the laboratory. The solution will very likely turn out to be absurdly simple and obvious, once we get hold of it; but meantime it is a tough and nagging mystery.

While waiting for something else to happen, it is interesting, if not really profitable, to take stock of the information at hand and see what can be done with it. Most of the laws of science, as we call them, have started out as theories; and theories are just figments of a disciplined imagination — until they can be proved. The scientific way to formulate a theory is to examine every possible explanation for your facts that presents itself, however outrageous it may seem at the

time. Some of the craziest notions turn out to be the best.

In the case of the ridley mystery, then, we have to weigh without bias all the trial solutions



at hand, whether conceived by unlettered men-haden hands or by sadistic colleagues, or by my own troubled mind. We must list these and evaluate each in its turn and then make an objective choice; and this will then be the current, tentative answer to the riddle of the ridleys. It will probably be wrong, but it will be the best we can do.

Of all the explanations that suggest themselves, the simplest is that the ridley just doesn't reproduce, but arises by spontaneous generation. This is the most direct answer, in view of what we know, and in olden times it would have been accepted as the only reasonable solution. But nowadays biologists are pretty insistent that everything alive must have at least one parent, and this sets limits to our imagination.

As a variant of the above, we might toy with this idea, which has been suggested to me independently by several acquaintances, some of



➤ *Its eyes water copiously while the eggs are dropping into the nest, and the head lies prone against the sand.*

Like other sea turtles, the Pacific Ridley simply covers her nest and returns to the sea. Presumably the Atlantic Ridley does the same thing. But where? ➤

(Photographs by Margaret Hogaboom)



whom at least are perfectly sane. May not the ridley once have been able to reproduce its kind, but have suddenly lost the ability — have become sterile through some sudden racial mishap? In such a case, the ridleys we see today would be the last members of a line on its way toward extinction. It is hard to put your finger on the defect in this effort, but it seems a bit fey and irresponsible. Quite frankly, I get no real comfort out of the notion and mention it at all only to be scientific.

We just about have to start from the assumption that the animal breeds — somehow, somewhere. It must be, then, that it is the place or the manner of the breeding that bewilders. There must be something about where or how little ridleys come about that it is just a bit beyond the scope of our imagining.

Maybe, for instance, this turtle lays no eggs, but bears its young alive, on the high seas, as a sea snake does. It is certainly conceivable, and it excuses our failure to find nests and eggs ashore. But don't forget the lack of pregnant females. You have to get just as pregnant to bear live young as to lay eggs. And not only that, an eggless turtle is too far out of character. Turtles are unwaveringly conservative. A live-bearing turtle would be almost as exciting as an egg-laying dog. No matter where they live — on dry land, in fresh water, or in the sea — all known turtles inflexibly dig holes and lay white-shelled eggs in them; and they have been doing this since the Cretaceous.

Suppose, then, that the ridley abides by the conventions of its kind and lays eggs, but lays them in the water — lays buoyant eggs so far from land that the young stop being young before we ever get to see them. If the laying place is very far away, maybe it takes the females a long time to get there, and we see them only when they are not carrying eggs. This is a variation of the preceding theory and a slight improvement on it, but is unacceptable on the same grounds. It just seems like too much of an innovation for a turtle suddenly to make, after fifty million years of making hardly any innovations at all. Besides, prolonged wetting with salt water kills the embryos in the eggs of other reptiles and other sea turtles, and we would have to propose a brand-new and very ingenious kind of egg for our theoretical pelagic ridley.

Perhaps, instead of a strange *way* of breeding, it is a strange *time* of breeding that has thrown us off. Maybe the laying season is very short or very oddly scheduled and restricted in time. Maybe they lay only on New Year's Eve or Twelfth Night, or on the shortest night or coldest night of the year. All the other Atlantic sea turtles have a laying season of several weeks in late spring and early summer; but the ridley may lay in midwinter when turtlehunters are doing something else. Why not? Well, mainly because it again brings us up against the failure of the females to turn up pregnant. And not only that, even in the dead of winter there is traffic on most Florida beaches — people driving, hotrodding, surf fishing, courting, catching coquinas, even swimming. It is impossible to believe that winter turtle tracks, or tracks laid at any time however unlikely, could simply have escaped notice. This was Kemp's theory, you remember, but I think he was just repeating idle talk.

Next we might try the possibility that the ridleys in the United States originate somewhere else and either migrate into the Gulf of Mexico or are carried there by currents. This looks good at first, because there are the currents to do the job — currents that could, and almost surely do, bring ridleys clear across the Atlantic from Africa to the Antilles and very probably into the Gulf of Mexico. But if you look closely at the foreign ridley colonies that could lose turtles into these currents, you see that the ridley population in the Gulf could not possibly be derived this way. In the first place the Gulf form is too abundant to qualify as an accumulation of accidental waifs; and even more conclusive, there is a simple but constant difference between the ridleys in the Gulf and those in West Africa and on the Pacific coast of South America, which are the only stocks adjacent to the currents that bring foreign drift into Florida waters. All extra-Floridian ridleys everywhere in the world have two to six more scales in the upper shell than our Gulf ridley does. If we suppose that all those in the Gulf were brought in by the Equatorial Current, then we have to believe that each of them stopped over somewhere along the way and had its shell remodeled. It is possible that an occasional Gulf ridley does come into American waters on the Equatorial Current; but if so it is surely one

that began its voyage three years before when it was swept away by the Florida Current and survived the world-wide circuit to return at last to its native waters. Any African ridley that turned up in the Gulf would be easily recognized as such. There is, thus, little point in looking to the ocean currents for a solution to the puzzle.

Why not just take it easy and accept the popular notion that the ridley is a hybrid after all, and, like many hybrids, sterile? This is what most of the fishermen and turtlehunters believe, as I have said, and you can even read it in the *Riverside Natural History*. Mostly the responsibility for furnishing us with ridleys is laid to a loggerhead father and a green-turtle mother, but sometimes you hear the sexes switched. A few say the *mésalliance* involves a loggerhead and a hawksbill, and rarely you may be told that it is a hawksbill and a green.

This is where the pressure is, and where my skepticism has lost me friends and made me out, in the eyes of men I respected, a plain damn fool. Nearly everything we know, and everything we don't know, about this animal makes it easy to say it is a half-breed, with no more personal continuity than a medieval choirboy, or a mule.

As I have said before, there are also ridleys in the Pacific. And in the Pacific the males chase the females about, and catch them, and they mate, and the females go ashore and dig holes in the sand and lay round, white eggs in them. The eggs hatch and release baby ridleys with egg teeth and umbilical scars, like any other new turtle.

Now, what earthly sense would it make for the ridley to be a hybrid in one part of his range and a separate species in another — to do his own breeding at Acapulco but rely on other kinds of turtles to do it for him at Tampa? It is a distressing thought. In fact, it is untenable.

As I have pointed out, the Atlantic and Pacific ridleys are separated by a great deal of territory and are not exactly alike. But they are very nearly alike, and far more like each other than like any other kind of turtle. In fact, the only differences I have been able to make out are the extra scales in the shell of the Pacific form and sometimes a slightly greener color; and maybe a few trifling disparities in proportions. Certainly nothing that would lead a person with bat brains to believe

that a ridley begot one of them and a loggerhead the other.

The problem would be simple if we didn't know about the Pacific ridley. My friends around the fish houses don't know about the Pacific ridley. They are at peace. I am not. It's what a Ph.D. in biology gets you. . . . The ridley breeds, like anybody else.

The same objections that make the hybrid idea unsatisfactory seem also to throw out the possibility that the ridley is some sort of sport — an occasional freak occurring among normal offspring of one of the other kinds of turtles, the loggerhead, for instance. Here again the almost identical Pacific ridley, with its orthodox breeding habits, stares us in the face and makes the sport theory seem just a shade too easy. It is possible, but only very feebly so.

Now, what can be said to the people who suggest that the nests have just been overlooked — that ridleys nest right along with the other turtles, at the same time and in the same places, and have simply escaped notice by a person competent to distinguish between them and the other species?

Well, as far as I'm concerned those are fighting words. Maybe my own hundreds of hours of unproductive beach-walking, and those of my zoological friends and correspondents, are not a valid test. But how about the lifetimes spent without seeing ridleys by professionals like Joe Saklin and Tony Lowe and Paco Ortega, and by the band of my consultants among the illegal east-coast turtle-hunters? These men spend three months of every year patrolling the beaches in turtle buggies — cut-down cars with oversized tires — dodging the far-spaced conservation officers and turning turtles by the yearly hundreds. They have always done this and they keep doing it at growing risk — slowly growing risk — because a few commercial bakers have learned what Savannah and Charleston housewives always knew about the keeping qualities turtle eggs give cakes, and will pay fantastic prices for them; and because the shoddier jooks and barbecue joints along the Dixie Highway like to cut their fifty-cent-a-pound hamburger meat with twenty-five-cent loggerhead. These men don't hunt turtles for fun. They are tough and practical. I know a game warden whom they threw into the sea

just to show how tough they are. They know their business. They know ridleys and know the beaches and what goes on there during the long summer nights, and it is wonderful what goes on there, but it is not the nesting of ridleys. All these men have told me that ridleys never come ashore. By not moralizing on their ways, I have made friends among these poachers, and if a ridley ever comes up on one of the good mainland beaches in the turtle season, I bet I hear about it within hours.

But suppose she should not come ashore on one of the good turtle beaches. There is a lot of coast between Tampico and Beaufort, and there are still some unpatrolled, unbathed-on segments of shore not even shown as sand on maps. And as long as this is true, we can never be sure but that we have missed what we were after simply because we have not looked in the right place. Till every one of the unsearched beaches has been walked with ridleys in mind we can never be sure they do not nest on some rarely visited little island or cluster of keys or short, broken strand somewhere on the coast of the southeastern United States.

This, I believe, is the theory we must choose. It best fits the known facts and introduces the fewest wild assumptions. It is distasteful, because it proposes the laborious ransacking of every scrap of sand along hundreds of miles of coast. It seems unlikely, because no other turtle anywhere is so fanatically finicky in choosing a breeding ground as this explanation would imply. But the ridley has shown its disregard for tradition in other ways, remember. In spite of the drawbacks, this hypothesis seems the best of the lot.

So I guess we must go looking for a small, isolated stretch of shore as the answer to the ridley mystery. It must be some improbable place right under our noses. Cape Sable may occur to you, or Dry Tortugas, but it will not be so easy as that. People have been turning turtles on those shores for too many years. I believe it can't be any of the good turtle territory on the east coast — the strip from Palm Beach up to Melbourne: it is too well known, too continuously visited. It is not Sanibel or Bonita Beach or Naples, and it almost surely is none of the islands along the bend of the Panhandle. It barely might be outside Florida — one of the Sea Islands of Georgia or

South Carolina, or some place the Mexicans have somehow missed between Vera Cruz and Brownsville. But I doubt this; and I doubt that it is anywhere in all the island chain from Grand Bahama to Turks and Caicos.

As long as we believed the zoologists who kept quoting one another about there being ridleys in the Caribbean, we could just say, well, hell, the ridley must breed down there somewhere. But now there's no comfort there, for me at least. In all the poking about that I'm going to tell you of in chapters to come, the ridley mystery was right there with me. Stirred up as I may seem over other matters — over the green turtles I was mainly after down there, over the endless odd detours and distractions I relate — the one most exciting thing I found in all my wandering was no ridleys in the Caribbean.

What remains to be done, then, is slow, piecemeal searching. And before I look anywhere else I am going back to Florida Bay — to the shallow, island-set sea between the cape and the upper keys. There are dozens of little islands there like Sandy Key, and they have been little visited by naturalists with eyes open for ridley sign. The shores there are mostly mangrove thickets, where no turtle could nest; but in some the mangrove fringe is broken by sand; and while the strips of beach are short and narrow, they may be all the ridley needs. The bay is handy to both the Florida Current, which must be the agent that feeds the waifs into the Gulf Stream, and to the coastal waters of the peninsula of Florida, where ridleys are more abundant than anywhere else. It is at least possible that the natural secretiveness of sea-turtle hatchlings keeps baby ridleys out of sight, and that some local, seasonal migration of the egg-heavy females hides them from view. All this seems unlikely, but it is the most possible solution at hand.

So I guess I should have stayed on there in the bay to look for the answer, where Jonah Thompson threw the iron so long ago. Perhaps all the Atlantic ridleys everywhere come from down there where the first one was, in the hot, white water with the sea cows and bonefish and the last crocodiles. Maybe the long questing will come full circle there on some first full moon of summer, and the riddle of the ridley will end where it began.

News from the Conservation Foundation

Ecologist Abroad

Because of its interest in the work of the International Union for the Protection of Nature, the Conservation has made it possible for Dr. Edward H. Graham, Director of the Plant Technology Division of the U. S. Soil Conservation Service, to attend a meeting of the Ecology Commission of the I.U.P.N. in London in July. Dr. Graham's knowledge of American and European problems and practices complemented those of E. Max Nicholson, a British member of the commission, who was brought to the United States last spring with the support of the Foundation. The program developed by the commission at the July meeting suggests substantial results from these international exchanges.

Teachers' Handbook

Mrs. Martha E. Munzer has been engaged by the Foundation to produce a Teachers' Guide for high school use throughout the country, addressed specifically to teachers of chemistry, biology, physics and general science. An advisory and editorial committee consisting of Dr. Paul Sears, Dr. Paul Brandwein, Dr. Edward Dolder, Albert Burke and Dr. Stanley Cain is working with Mrs. Munzer and Dr. Brandwein will be co-author. Publication is expected in the late spring or early summer of 1956.

Education Survey Completed

In April of 1953 the Conservation Foundation engaged Prof. Charles E. Lively of the University of Missouri to make a basic research study which would determine both quantitatively and qualitatively the extent to which American Colleges and universities are teaching conservation.

No comprehensive survey of this sort had previously been undertaken and consequently there was no accurate knowledge on the part of educators or others interested in education as to the

existing status of conservation education. We believed that we could not project our own long-range education program without knowing what was already being done in this field at college and university levels.

Dr. Lively's study, in which he was assisted by Dr. Jack J. Preiss, formerly of Michigan State College, has now been completed and is under intensive review by members of our staff. It is evident that this study (approximately 350 pages long) has succeeded in accomplishing the task set for it. Arrangements are now being made for its publication and distribution.

Television Program

Previously mentioned in these notes was the fact that our educational films will form part of a 26-week television program to be produced by Thomas Craven, Inc. Other films on the program are based on photography by John Storer. Editing is virtually completed and we expect an early release.

Radio Series

The Conservation Foundation and the National Broadcasting Company are preparing a 13-week program of half-hour radio shows on conservation topics. The first show should go on the air at the end of October or during the first two weeks of November, on a national network basis. Later the program will be re-broadcast over educational networks.

Jamaican Studies

In response to interest expressed in Jamaica, Robert G. Snider, Research Director of the Foundation, spent a week in Jamaica during August investigating the possibility of further studies bearing on the population-resources problem. A plan has now been drawn up to guide possible further field studies.

BEHIND THE SCENES

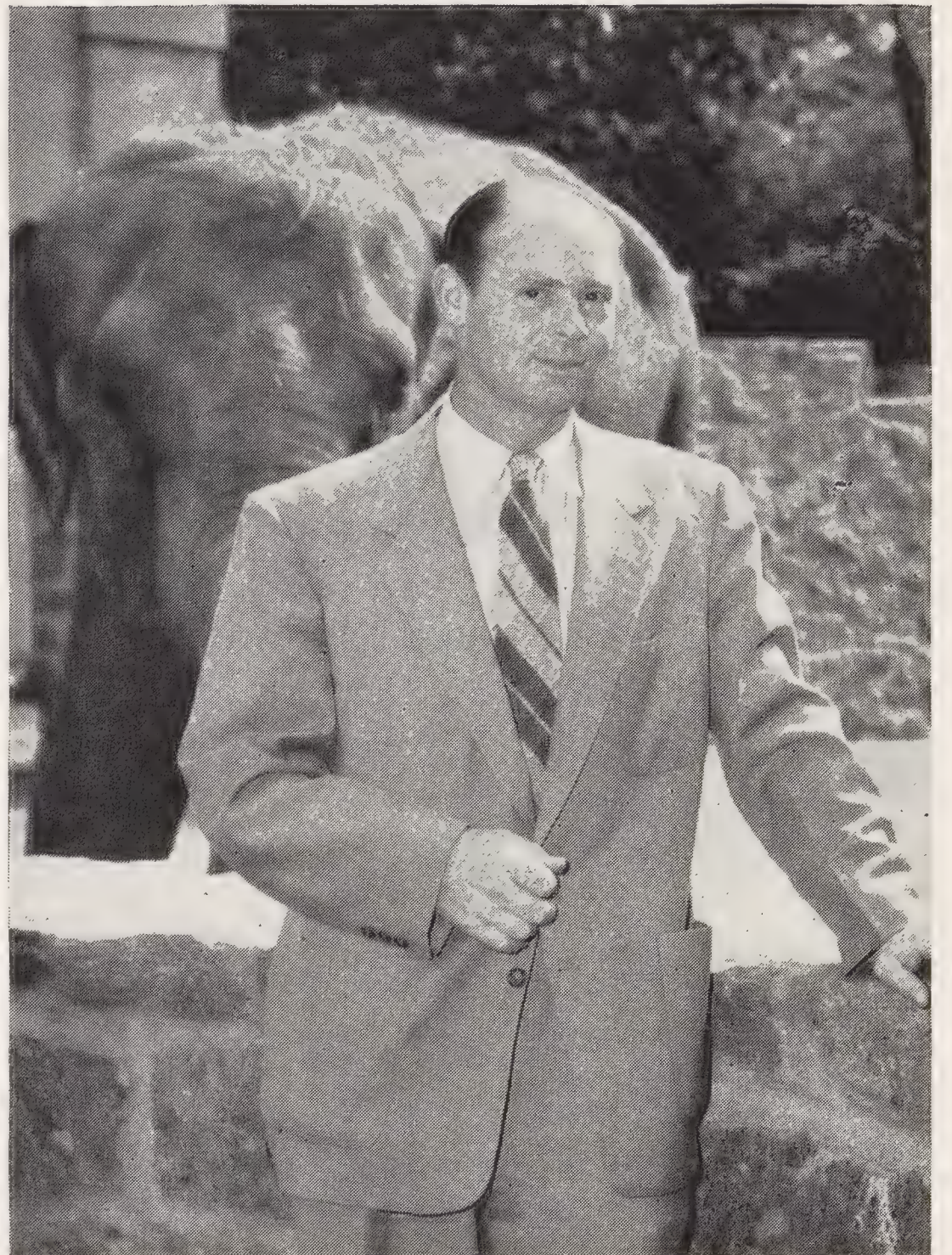
NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Dr. Richard H. Manville Appointed Curator of Mammals

Dr. Richard H. Manville, formerly Associate Professor of Zoology at Michigan State College, has been appointed Curator of Mammals at the Zoological Park and assumed his duties on September 15.

A graduate of Dartmouth College in 1932, he received a Master's degree from the University of California in 1935 and a Ph.D. from the University of Michigan in 1947. He has had extensive field experience as a Ranger-Naturalist in the National Parks Service and as a field collector and wildlife investigator for the University of Michigan.

Dr. Manville's publications are numerous and reflect his special interest in mammals. The Zoological Society may look forward with pleasure to his participation in the work of the Zoological Park. — JOHN TEE-VAN



Dr. Manville

President Osborn Honored

President Fairfield Osborn has been elected a Fellow of the American Association for the Advancement of Science.

Young Herpetologists Form Reptile Club

Although the Zoological Park must, perforce, do a wholesale job of teaching young people about animal life — through exhibits and the organized activities of our Education Department — the special interests of young herpetologists have led to the formation of a Reptile Club under the supervision of Curator of Reptiles Oliver.

The club was started in an informal way last spring with monthly Saturday morning meetings in the laboratory of the Reptile House, where Dr. Oliver guided discussions of snakes, frogs and turtles most of the members were keeping at

home. The meetings resumed Saturday morning, September 24, with 37 persons present, including four girls. They elected Nat Sloan of Yonkers as President, Richard Milner of Queens as First Vice-president in charge of membership, Douglas Futuyma of the Bronx as Second Vice-president in charge of programs and Gerald Schneider of Brooklyn as Secretary. There are no dues, so no Treasurer was required. The club will continue to meet once a month, the next meeting being on Saturday morning, October 22.

All of the members are seriously interested in keeping reptiles as pets and in learning, by their own efforts, something about their biology. Dr. Oliver agreed to supervise the club and to permit it to hold its meetings in the Reptile House so long as the members worked out their own programs, presented their own papers, and were will-

ing to acquire knowledge through their own efforts. The response to this attitude has been good.

THE MORNING'S MAIL

A "Thank You" Note

SIRS —

When safely removed a considerable distance from your information center, I learned that you publish a pamphlet on turtles [The Care of Turtles and Small Alligators]. I am therefor enclosing 24 cents in stamps for it.

The zoo . . . seemed as impressive as ever. I noted particularly the spectacular quality of the exhibits: so many that are remarkable and memorable, instead of just a miscellany of indistinguishable African antelopes, tropical birds, etc. The finches held my children for ten minutes. I don't think they sufficiently appreciated the penguins and the okapi, but they were the first I had seen, and I've visited lots of zoos, persistently. Your great cassowary was a new one to me, also the giant otter, the large frog, and the hybrid fish. I can't remember having seen two yellow cocks-of-the-rock anywhere else. And of course you seem somehow to maintain that wonderful collection of birds of paradise.

All this is merely by way of saying thank you for maintaining the entire zoo. Like me, most of the persons who visit it must be neither naturalists nor scientists, but merely persons who like to look at animals and learn about them. I regret not having had time to read each detailed explanation carefully; these seem to me to add a great deal, and are in excellent style considering their purpose.

W. H. FRENCH
Ithaca, New York

IN BRIEF

Hand-fed Kings. When we successfully hatched nine King Cobras between July 4 and July 12, the Reptile Department realized that it probably was going to have a difficult time getting the youngsters to feed. The department has not been disappointed. Three of the babies have died, and the others have to be hand-fed at intervals of about ten days. They take only other snakes, and part of the problem has been that of securing a steady supply of very small Garter, Black Racer, Water and Green Snakes. Once the snake is started down a baby King's throat, it swallows readily enough, but none has yet tried to feed of its own accord. Nevertheless the snakelings have increased from half an inch to an inch in length since hatching. They average a little more than 18 inches.

NEW YORK


"FARM-IN-THE-ZOO"

TAKE THE CHILDREN TO
BRONX ZOO'S FAMOUS FARM.

SEE MANY BREEDS OF CATTLE, HORSES, SHEEP,
PIGS, POULTRY . . . BABY CHICKS HATCHING . . .
COWS BEING MILKED.

IRT WHITE PLAINS ROAD LINE TO PELHAM PARKWAY
STATION. (FOR MAIN ZOO - GET OFF AT 177TH ST.)

OPENS AT 10 A.M. FREE



One of the most popular operations at our Farm-in-the-Zoo is advertised on the subway.

Success at Last. Several years ago when a Nankeen Night Heron in the Large Flying Cage lost her mate, she paired up with a male Black-crowned Night Heron and enthusiastic but unproductive nest-building has occupied their time for the past few seasons. Accustomed to finding stones in their nest, Keeper Bell was pleasantly surprised this year to discover the Nankeen sitting on an egg. It hatched on August 24 and the youngster is doing well.

Long-lived Vulture. On July 3, 1922, we received a young Ruppell's Vulture from North Africa and it led an uneventful life in the collection until August 20 of this year when it died. Its longevity in the Zoological Park was 30 years, 1 month and 17 days, which is believed to be a new record for the species.

Honors for Sam Dunton. Staff Photographer Dunton was made a Fellow of the Biological Photographic Association at its meeting in Milwaukee at the end of August, for "Distinguished craftsmanship and conspicuous contributions to the advancement of photography in the biological sciences." At the same meeting his photographs entered in the Natural Sciences section of the Association's salon won First and Second prizes and an Honorable Mention. At the conclusion of the convention, the paper by Mr. Dunton and Henry M. Lester, our Photographic Consultant, on "Motion Picture Photography of a Rattlesnake's Strike," was judged the best of the meeting.

Sea Cucumber-Saver. Three years ago Dr. Nigrelli discovered a pharmacologically-interesting substance named Holothurin. It can be extracted from the viscera of one of the sea cucumbers, *Actinopyga agassizi*, and has turned out to be of such great interest that two or three other research groups also have been making collections of the animal in the waters around the Lerner Marine Laboratory at Bimini, B.W.I. The inevitable result is that sea cucumbers are rapidly becoming scarce in that area. In August Dr. Nigrelli collected 1,000 sea cucumbers for chemical analysis, but did not find it necessary to destroy them to obtain the viscera — the organs that secrete Holothurin. This sea cucumber has a habit of everting its viscera when disturbed, and it is only necessary to remove the extruded portions and return the animal to the sea, where it regenerates its internal organs.

PUBLICATIONS OF INTEREST

VULCAN, THE STORY OF A BALD EAGLE. By Robert M. McClung. Numerous black-and-white drawings by Lloyd Sandford. 64 pages. William Morrow & Co., N. Y., 1955. \$2.

This is another in the excellent series of nature books for children by Mr. McClung. Careful adherence to factual accuracy applied to abundant action will make certain that while the child's interest is held, much sound lore of the eagle will be absorbed. The drawings of Lloyd Sandford, Staff Artist of the Zoological Park, add much to the attractiveness of this little book.—L.S.C.

DOCTOR JIMEK I PRESUME. By Bernhard Grzimek. 22 photographs in black-and-white. Thames and Hudson, London, 1955. 16 shillings.

This lively account of a visit to the Ivory Coast by the Director of the Frankfurt Zoological Gardens was first printed under the German title "Flug ins Schimpansenland" and was translated into English by R. H. Stevens. Dr. Grzimek's chief purpose, of course, was to study animals in nature and to bring back such as he could for his Zoo. Like most naturalists, however, the author has a deep interest in people, so that engaging accounts of the natives are interspersed with experiences with chimpanzees, hippopotamuses and termites. Style and treatment are light and amusing as well as informative, certainly with some credit to the translator. — L.S.C.

BIRD HOUSES. By Edmund J. Sawyer. Pp. 36, many drawings. Cranbrook Press, Bloomfield Hills, Michigan, Bulletin No. 1, Fifth Edition, 1955.

This small booklet contains a wealth of information on how to make and where to place bird houses, baths and feeding shelters. The author's charming illustrations and comprehensive text combine to make a helpful guide for those who wish to encourage wild birds near and around their homes. — D.R.

THE BEAST THAT WALKS LIKE MAN. By Harold McCracken. 15 photographs and drawings in black-and-white. Hanover House, Garden City, N. Y., 1955. \$4.50.

Drawing freely upon his own field experience, interwoven with the results of extensive research of records and publications, the author has produced a history of the great Grizzly Bear from earliest times to the present day. Indian legends, attesting the importance of the great carnivore in the lives of the primitive human inhabitants of the western parts of America, tales of the adventures of early hunters and events of more recent occurrences, round out a story of much interest and no little pathos. For, from a collation of the reports of Game Commissioners, Mr. McCracken estimates that no more than 875 Grizzlies, including those in National Parks, were still living at liberty in the United States in the years 1953-1954. "Old Ephraim" has come upon bad times. — L.S.C.

WORLD OUTSIDE MY DOOR. By Olive Bown Goin. Illustrated with line drawings by Esther Coogle. Pp. viii + 184. The Macmillan Company, New York, 1955. \$3.50.

Few states afford so great a wealth of opportunities for the backyard biologist as the State of Florida. Olive Goin and her biologist husband, Coleman J. Goin, have been recording the life outside their door near Gainesville, Florida, for a number of years. They have had many interesting experiences and made numerous original observations. Here Mrs. Goin presents in informal and anecdotal style a picture of the world outside her door. — J.A.O.

GREENHEAD. By Louis Darling. 95 pp. Illustrated by the author. William Morrow & Co., New York, 1954. \$3.00.

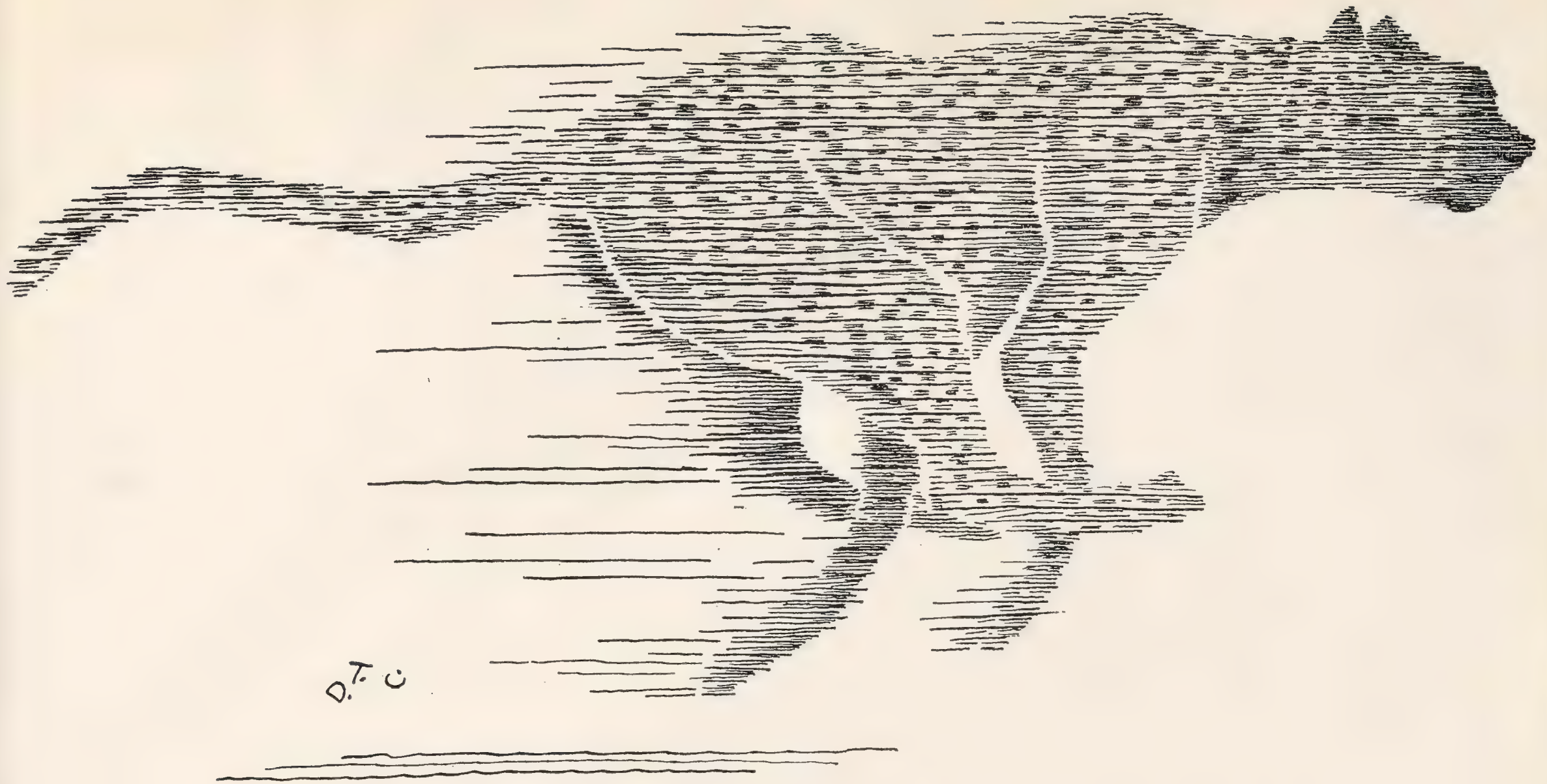
This attractive, fact-filled book, purportedly the life story of a Mallard Duck, really serves better as an introduction to ornithology in general. Bird anatomy, physiology, food habits, migration, and conservation are discussed in straightforward, interesting style, and profusely illustrated with excellent black-and-white drawings. Should serve as a useful introduction to waterfowl in particular, the study of birds in general. — R.M.McC.

PET HAMSTERS. Anthology. Eleven black and white illustrations from photographs and drawings. 28 pp. All-Pets Books, Inc., Fond du Lac, Wisconsin. 1955. \$.35.

It is not often that so much plainly and sensibly written information is contained in so few pages. This little booklet condenses all the beginner needs to know about this attractive little animal. The illustrations are as practical as the text and include photographs of new albino and pied color varieties. Nothing could be more helpful for use in the school nature room. — L.S.C.

ZOO PETS. By William Bridges. 50 photographs in black and white by Sam Dunton. 94 pp. William Morrow and Co., New York, 1955. \$2.50.

This latest production of our indefatigable Curator of Publications is well up to the level established by his earlier efforts. The same charm, humor and genuine interest in the lives and behavior of animals, applied with commendable lack of sentimentality, give a sense of reality not readily achieved by lesser talents. The type is large and there is a hazy implication that the age level is "six to ten" or perhaps "eight to twelve." But there is no rule that will prevent "twelve and upward" from enjoying these captivating tales of animals in the zoo. Sam Dunton's superlative photographs add much to the attractiveness of the book. — L. S. C.



Quick, like a Cheetah!

Those names! Those addresses! Those people you *know* will enjoy their memberships, as you have done, in the—

New York Zoological Society

Just use the card bound into this magazine, and mail to:

MEMBERSHIP DEPARTMENT
New York Zoological Society
30 East 40th Street
New York 16, New York

SO YOU'RE GOING TO THE BRONX ZOO! HERE'S HOW—

AUTOMOBILE. *From east New York City and Long Island:* East River Drive N. across Triboro Bridge; Northeast on Bruckner Blvd. to Bronx River Parkway; North to Exit 5 for Bronxdale Parking Field of Zoo, or Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field.

From Long Island: Across Bronx-Whitestone Bridge, continue on Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), thence W. to Zoo.

From west New York City and New Jersey via tunnels: Henry Hudson Pkwy. N. to Dyckman St. and Broadway; N. on B'way to 207th St.; turn E. on 207th St., Fordham Rd. and Pelham Pkwy. to Zoo.

From New Jersey via George Washington Bridge: Through tunnel at east end of bridge, up ramp marked "Bronx-Bronx

Whitestone Bridge," E. to University Ave., N. on University to Fordham Rd., E. on Fordham to Zoo.

From Westchester and Connecticut: Merritt Pkwy. S. to Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), OR Bronx River Pkwy. S. to Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field, or Exit 5 for Bronxdale Parking Field.

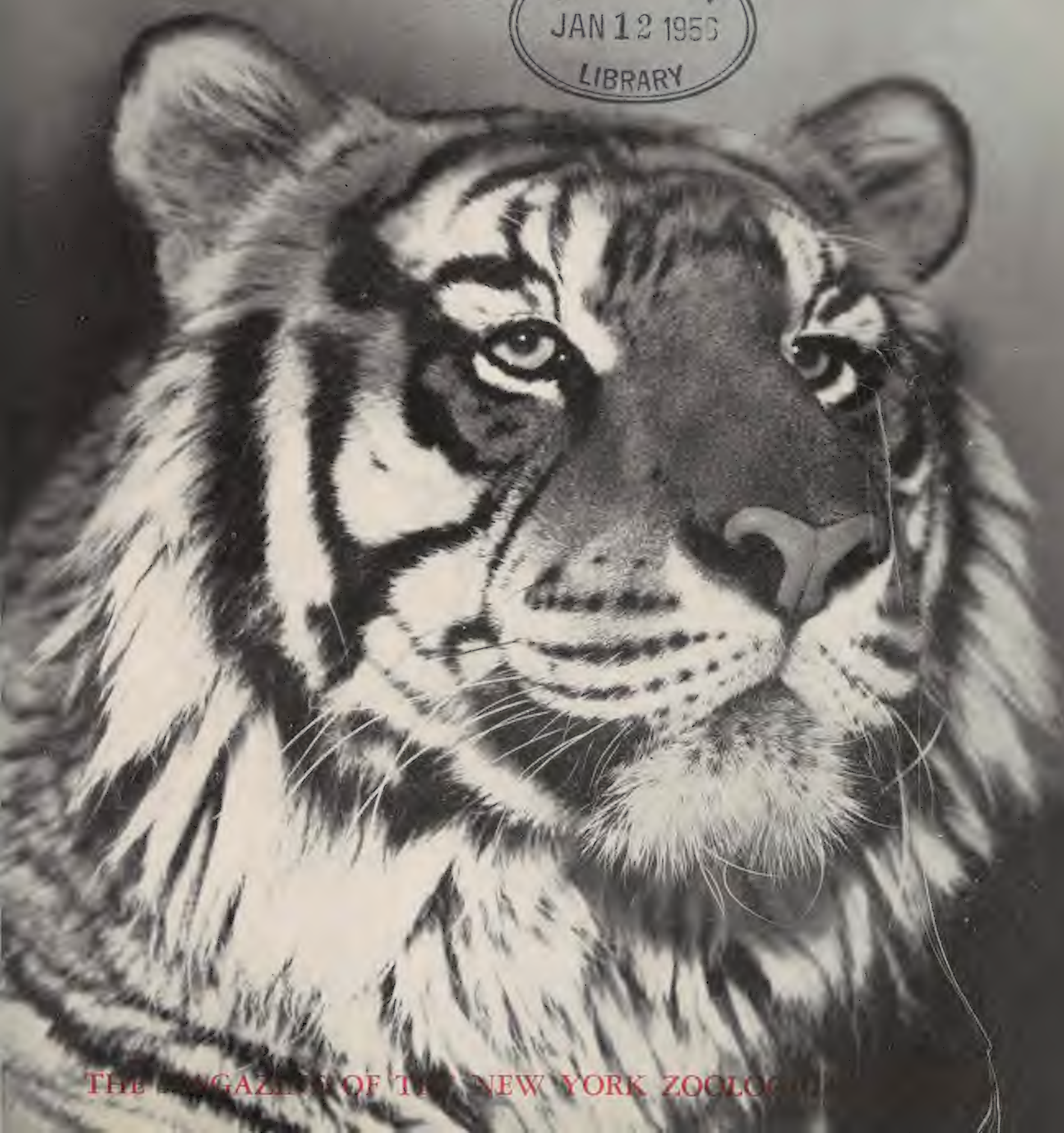
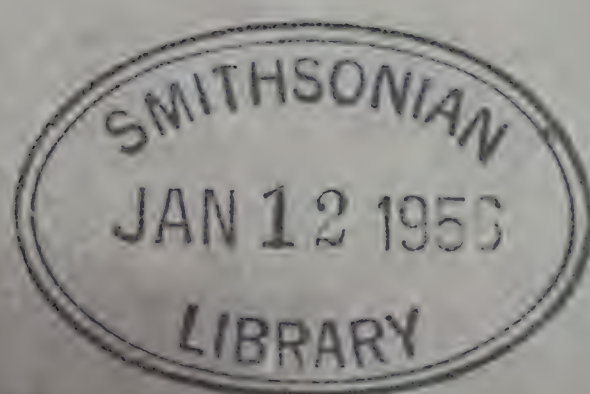
From western Westchester and upstate: Sawmill River Pkwy. S. to Moshulu Pkwy., skirt Botanical Garden southward to Pelham Pkwy., turn left to Pelham Pkwy. gate and Fountain Circle Parking Field.

SUBWAY. *West Side (IRT):* Northbound East 180th St. Express to 177th St. Walk N. to Zoo.

East Side (IRT): Northbound 241st St.-White Plains Rd. Express OR East 180th St. Express to 177th St. Walk N. to Zoo.



ANIMAL KINGDOM



NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT Fairfield Osborn	VICE-PRESIDENTS Alfred Ely Laurance S. Rockefeller Donald T. Carlisle	SECRETARY Harold J. O'Connell	TREASURER David H. McAlpin
		ASSISTANT TREASURER Percy Chubb, 2nd	

EXECUTIVE COMMITTEE

Laurance S. Rockefeller <i>Chairman</i>	<i>Class of 1956</i> Archibald S. Alexander A. Raymond Dochez Robert G. Goelet De Forest Grant Eugene Holman Warren Kinney William De Forest Manice Harold J. O'Connell Landon K. Thorne J. Watson Webb
George F. Baker, Jr. John Elliott Alfred Ely Robert G. Goelet De Forest Grant David H. McAlpin Robert Moses Harold J. O'Connell Fairfield Osborn Edwin S. Webster	

BOARD OF TRUSTEES

<i>Class of 1957</i> Robert E. Blum Percy Chubb, 2nd C. Suydam Cutting Alfred Ely Marshall Field Childs Frick Henry Clay Frick Archer M. Huntington David H. McAlpin Richard C. Patterson, Jr. John H. Phipps	<i>Class of 1958</i> George F. Baker, Jr. F. Trubee Davison John Elliott Robert I. Gannon Peter Grimm Fairfield Osborn Eben Pyne Laurance S. Rockefeller John M. Schiff Henry Sears Edwin S. Webster, Jr.
--	--

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Richard H. Manville *Curator, Mammals*
Grace Davall *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandal *Assistant Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch *Assistant Curator, Education*
Quentin Melling Schubert *Superintendent,*
Construction and Maintenance
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. *Research Associate in Ichthyology*
Harry A. Charipper *Research Associate in Histology*
Homer W. Smith *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez Caryl P. Haskins
Alfred E. Emerson K. S. Lashley
W. A. Hagan John S. Nicholas

AFFILIATES

C. R. Carpenter, *Co-ordinator*
Animal Behavior Research Programs
L. Floyd Clarke, *Curator*
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen Samuel H. Ordway, Jr.
George E. Brewer, Jr. Hugh J. Ross
Donald T. Carlisle Robert G. Snider
John C. Gibbs Peter M. Stern

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

Bengal Tiger: "Rajpur"
Sam Dunton Cover

The Lowland Gorilla
Lucien Blancou 162

Where Do Animals Go in
Winter-time?
William J. Hamilton, Jr. 170

In the Bag with Andy
Sam Dunton 176

New Arrivals and News
Sam Dunton 179

Zoo-goer in Asia
William Beebe 182

News from the
Conservation Foundation 187

'56 Will Be a Great Year 188

Behind the Scenes 189

Index to Volume LVIII 190

Vol. LVIII DECEMBER 1955 No. 6

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

Livingroom for Animals

IT IS OFTEN DIFFICULT to determine what is of lasting importance. In our world today, when the numbers of D.P.s and homeless people are legion, why, for instance, should we concern ourselves with the survival of wild animals, some of which, at this very time, are being crowded off the face of the earth? It may sound heartless or even ironical to say that wild animals are precious because once gone they are gone forever, while, on the other hand, people are becoming so numerous that maybe there are too many of them — not merely for the good of wild animals but for the good of people themselves!

These brief observations, however, are not concerned with the world population problem as such but with its effect upon a considerable number of different kinds of mammals and birds that are nearing the point of extinction. In our own country their situation is not too serious as yet, because of protected areas in National and State Parks, wildlife refuges and the few, very few, remaining wilderness areas. However, the pressure against these regions is constantly increasing, as we all know. Within another twenty years, with the prospect of another 40 or 50 million people in our country, the crisis for many forms of wildlife will really occur. This crisis is already evident in other parts of the world — for instance in the Far East where some species of superb animals seem doomed unless heroic actions are taken on their behalf. Likewise the crisis is threatening now even in Africa, in that vast yet shrinking home of many of the world's greatest mammals.

Home for people gives a promise of refuge and contentment. *Home* — meaning natural environment — for animals is a matter of life or death. Bullets may or may not, depending on man's mercy, spell the end of rare animals. But if wild animals are deprived of their *home*, their own "living room," they surely will perish.

Does man really wish to survive on an earth devoid of nature's rich company of living things? We must believe the answer is "No" — man does not wish to live alone.

Our Society, for its part, is bound by both its original charter and its present conviction to fight ceaselessly for the cause of wildlife protection.

Fairfield Osborn

DEC 22 1955

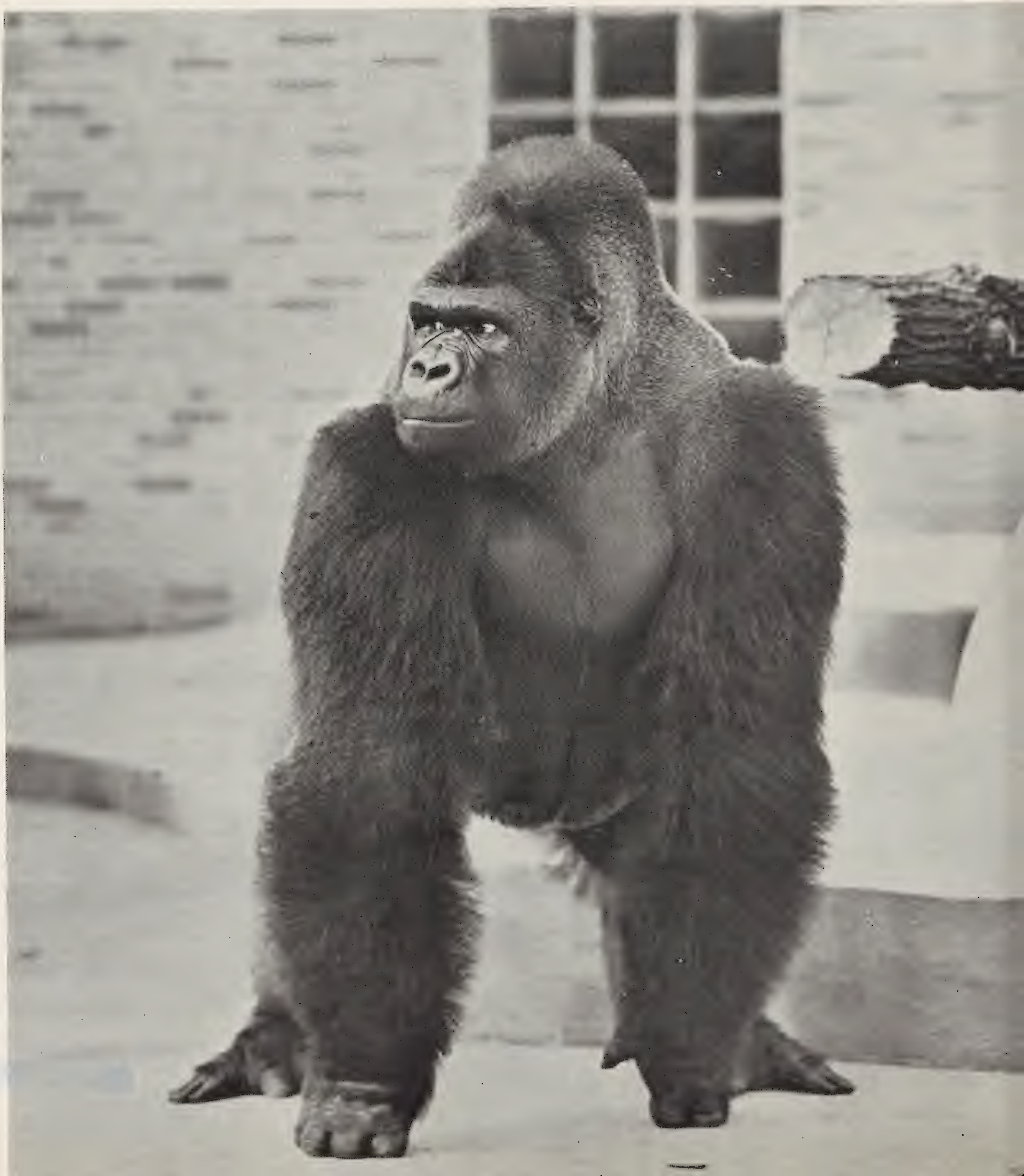


The Lowland Gorilla

By LUCIEN BLANCOU

Chief Game Inspector for France Overseas

Translated from the French by Lawrence G. Blochman



DESPITE THE GREAT LACK of detailed knowledge concerning the private and communal life of the gorilla at home, there has been a considerable amount of inexact material written on the subject.

Our scanty and erroneous information may be blamed on the small number of expeditions devoted to the study of the habits of these anthropoids and even more upon the difficulties of observation in their almost impenetrable habitat. Nevertheless, the series of expeditions in recent years, particularly since 1948, which have resulted in the capture of live gorillas even though that was not their exclusive purpose, have brought us new and precise data.

One bit of widely-circulated information about the gorilla which happens to be fact is that he travels in bands, or, more exactly, in families. These groups may number from three individuals to thirty-odd. Although it is often very difficult, if not impossible, to get an exact count on these groups, I am personally convinced that the figure thirty is rather common, at least in certain regions and at certain seasons.

It is to be noted, in fact, that near the Atlantic Coast in the west of Africa the families are much rarer, much more dispersed, and much less numerous than in mid-continent near the Equator and particularly north of the Equator. Along the coast of Gaboon and further south in the Mayombe mountain ranges, the family cell seems to dominate: father, mother, and one or two offspring. We might legitimately attribute the small number in this group to the encroachment of man, but it cannot be the only reason, for it would seem that the situation was the same a hundred years ago when the celebrated Paul du Chaillu explored this same coast. And if the human population may then have been more dense in certain regions, there were not yet the

timber and mining operations that we know today.

What is the composition of the gorilla family group? Except for the simplest example, a couple and one offspring, there seems to be wide variation that follows no rule. Here are a few precise examples: In February, 1951, between the Equator and the 1st parallel, South Latitude, in the Middle French Congo not far from the Gaboon frontier, a gorilla group surrounded for capture between the stations of Ewo and Kellé, was composed as follows: one large male 5 feet 3¾ inches tall (measuring from top of the head to the heels), 7 feet 11½ inches arm-spread, 4 feet 10¾ inches chest circumference, about 400 pounds estimated weight; six females of different ages but all adult; and eight young ones — four males, two females, and two of undetermined sex.

In August, 1952, another group surrounded in the same area was comprised of one large male, four females, one young male of about five, and three other young ones of a year or less. A few days later, at some distance from this drive, another group yielded a male leader, seven females and only three young ones.

On the other hand, two groups encircled successively in August, 1951, included at least two males in each, one stronger than the other.

And finally, in January, 1953, during the filming of a motion picture called *Mogambo*, a family of ten animals kept captive inside a wire-mesh enclosure for eight days, was composed of two adult males (one of them old and almost toothless), one semi-adult male, four adults presumed to be females, three young males, but no sucklings. It is quite possible that some members became separated from this group during the encircling operation, for its composition does not seem to be quite normal.

It would doubtless be premature to draw conclusions from such a small number of examples. Certain positive facts do stand out, however. First of all it would seem difficult to maintain that the gorilla is not polygamous, at least when he has the opportunity. We can further state that there

A male Lowland Gorilla is a massive and imposing animal. This is "Makoko," formerly in our collection. He weighed 448 lbs. before his death in 1951.



Young gorillas and females are adept at climbing trees and they move from branch to branch somewhat clumsily but with considerable speed. Adult males stay on the ground.

Drawing by the author

exists a curious preponderance of males among the young, a fact confirmed by other capture expeditions, the cause of which is not apparent.

We thus have the right to suppose that, at least in the region under survey, the big males collect the most females possible for their harems, without, however, excluding from the group the presence of a lesser male whose rôle has not yet been determined. It is always the *Makassi* — the chief, in the Mbéti dialect — who takes the initiative in a fight, in case the gorilla group is attacked. And yet it was clear in the *Mogambo* group that the authority of the venerable chief, who was getting on, was beginning to be challenged by another adult male. The resulting per-

turbation in the group may explain the absence of nurslings, although it is true that nothing proves that the females released after the filming were not pregnant.

And now what is the basis for the existence of these gorilla bands in their habitat?

We may say in all certainty that the primary consideration is the search for food. Diet varies in quantity and quality according to the season and the place. The anthropoids are thus obliged to lead a life of perpetual wandering, although probably within a limited radius and to a degree varying with local conditions.

I had no opportunity to learn anything new about fights between males over the question of sexual domination of each troop. In the *Mogambo* group, the manner in which the old male fulfilled his rôle of chief was the object of special observation. It was he who rationed the food for the members of his tribe and who peeled the

pineapples and bananas supplied by the motion picture people before meting them out to his subjects. The natural resources inside the enclosure — young shoots, wild fruits, and roots — would have been quickly exhausted had not the film people brought in shipments of bananas and wild pineapples to distribute to their animal guests. The wild pineapples grew in profusion in the forests of the region and they were greatly favored by the gorillas, who preferred them to the bananas.

Among the other elements of diet noted here and elsewhere, those most sought after include various species of *Aframomum* or amomum (giant herbs) which are equally abundant in the rain forest and which possess active parasiticial qualities. Young gorillas eat these avidly in captivity on certain days, refuse them stubbornly on others, for no known reason. Other wild plants are

equally prized by the gorillas and are well known to the natives, but I cannot give the exact name of any except the parasol tree, *Musanga smithii*.

Observations on the possible meat-eating habits of the gorilla have been largely negative. Efforts were made in the Brazzaville Zoological Gardens to tempt young gorillas with freshly-killed birds. The birds met with total disdain each time they were offered. On the other hand I have the testimony of one European who, with several companions, reported having once seen a big gorilla sitting alone at the foot of a waterfall on the lower reaches of the Kwilu-Niari River, fishing with his hands.

It seems to be fairly well established that the gorilla is a diurnal animal that roves the forests by night only rarely at full moon — and even then he prefers an African's plantation to the forest. As a rule the gorilla awakens late and never starts

A "Makassi," or old male gorilla, bedded down before sunset with his arms around two young gorillas. The buttress roots of a tree are a favorite sleeping place at night.

Drawing by the author



his day very early. Once on the march, however, he races his rivals through the bush for his daily rations.

The nurslings are most often carried clinging to the back or neck of the mother. I have seen one report of a pair of twins so transported, but this does not seem to be a frequent phenomenon. I have personally seen a suckling clinging to the breast of his mother.

The male chief usually patrols the rear of his band for protection against attack, a practice which hinders the operations of trackers assigned to follow the gorillas until evening. In some cases the trackers have found the patriarch-sentinel in such bad humor that they have given up and beat a retreat.

About five in the afternoon, sometimes earlier (just as the hour of awakening ranges from six to seven in the morning), the gorilla band begins to look for a place to rest for the night. On this point, I have been unable to discover anything new in regard to the so-called "gorilla nests." However, I am convinced that those built on the ground are most rudimentary affairs — branches and leaves broken and beaten down at the foot of a tree or in the hollow or a thicket — just a place for a gorilla to sit or lie down, more or less supported by a tree-trunk or branches. In the *Mogambo* enclosure, the *Makassi* was observed thus several times, leaning against a tree in the evening, his arms around two young gorillas, one on each side of his imposing person. The whole group went to sleep thus, even before complete darkness. But there are also nests in the trees which perhaps do not serve exactly the same purpose. Adult males have nothing to do with them, since their weight and their impressive pot-bellies militate against their climbing trees. But the females, weighing as much as 160 pounds, climb well and high. They concoct all sorts of hammocks for themselves and their young.

I can vouch for the fact that on August 17, 1950, in the Kellé region during part of the afternoon, one of them built a "nest" of this sort merely by bending and breaking branches, just enough to hide completely her offspring of about one year. I myself watched the little fellow, stretching his arm above his hidden body, trying to touch the branch overhead, or, half-sitting up,

leaning nonchalantly against it. My eldest daughter, as well as Robert Reboussin, the animal painter, watched the building of this nest, and Reboussin devoted several canvases to the process. The operation was accomplished in a big tree, about 65 feet tall, in the middle of a clearing and in full view of the white and black hunters who formed a circle about the capture nets. Neither mother nor child seemed to pay the slightest attention to the spectators.

I think that I should point out here that despite many sincere statements to the contrary, a gorilla will not hesitate to climb trees to escape an enemy, particularly man. He will even run from branch to branch, clumsily, it is true, but with sufficient skill to escape from the encircling nets. The natives know this well, so well that their first precaution, after having closed the circle, is to cut down all neighboring trees which might serve as escape routes.

This is also the time, I believe, to insist upon the rather surly character of gorillas in general. Disputes are common within the group, although less so than among baboons I have known. The cry of the gorilla is rather temperate, as compared to that of the chimpanzee, but he is subject to sudden rages and he is perfectly aware when anyone is afraid of him, even when very young.

This brings us to an examination of the relations between the gorillas and the natives of western Africa. They can practically be summed up in one word: Fear! The fear is mutual and hereditary.

The constant quest for food, which is the basis of a gorilla's whole life, brings him into perpetual contact with human groups, at least in the inland equatorial regions — despite what may have been written to the contrary. These contacts first of all result in damage to man's husbandry. The damage may be of many kinds, but it is most destructive in the banana plantations. The anthropoids prefer the inside of the banana stalks to the fruit itself, just as they tear apart the sugar cane to get at the center. They also have an inordinate appetite for the oil palm and the cassava.

Conflict between gorillas and natives may thus result. The big males are audacious and ready to defend their females, while the mothers never seem to hesitate about running to the rescue when an offspring calls for help. In general, however,

it is the males who bring on the most violent clashes. I do not mean that the gorillas are always the aggressors. Quite the contrary. The proof that the aggressive gorilla is the exception lies in the fact that before official protection was accorded, hunters often had a hard time finding him. Not only the difficulties of the terrain came to the gorilla's aid, but his own skill in hiding from the human presence. It is nevertheless certain that in a country as heavily wooded as the gorilla's habitat, and in districts swarming with the big anthropoids, surprise encounters are inevitable. In such cases the gorilla, like many other animals when surprised at close range, will sometimes attack as his best defense, particularly when he is afraid of what he assumes to be an enemy. He rarely makes a sustained attack. A rapid charge accompanied by fierce gestures, more or less fierce growls, a bite or a more-or-less energetic blow — all this is followed immediately by a precipitous retreat.

In a general way it is easy to understand why in spite of everything the aborigines, particularly the women, greatly fear these animals with human faces which they are likely to meet at any hour of the day around the turn of a path or in the tangle of an old plantation. The inverse must be equally true. But the gorillas have few advocates to defend them.

So while we find few complaints about gorillas in regions where they live only in small families, wherever they rove the countryside in large bands the outcry against them is long, loud and, as is to be expected, often exaggerated or made up out of whole cloth. The best way to judge the extent of the exaggeration, as in the case of damage by elephants, is to go hunting for live gorillas. The hunter is quick to perceive that these animals supposedly encountered everywhere all year round become extremely difficult to find. The season of the year and the quarter of the moon, the condition of the vegetation and the period since the last drive, all are factors that hinder the hunter and add to the scarcity of the hunted. Some very extensive zones are even frankly labeled as completely devoid of gorillas except for a very few vagabond males.

But whenever the time and terrain are favorable and a gorilla group is sighted — even before — the African hunters begin their elaborate rou-

tine: rites of magic, feverish preparations, a war-like atmosphere. The natives emphasize the word "war," for the gorillas are no longer merely somewhat humanized apes; they are practically a human tribe of hereditary enemies.

The question has often been asked as to how numerous the gorillas actually are in western Africa. Since no true census has ever been taken and probably never will be, the question can only be answered with an estimate without palpable proof. Although such estimates are surely made in good faith, it seems to be the rule that they must vary in startling proportions. For instance, I recently read in a French book devoted entirely to the anthropoids, that a doctor who had served in western Africa reported the number of gorillas in the region at 200! On the other hand, during the Bukavu conference in 1953 the figure was given as more than 50,000 for the territories of Gaboon and the Middle Congo alone.

I am obliged to say that such affirmations are merely impressions and rest upon no solid basis. We cannot even be sure that those who make them have seen many gorillas in their home surroundings or have traveled extensively through their habitat. In the most favorable cases, the "experts" risk jumping to a conclusion that the gorilla is approaching extinction because they have seen neither live specimens nor their tracks (without even wondering if their absence may not be due to some local or temporary cause), or they indulge in fantastic operations of multiplication. Because one particularly propitious sector of forest really teems with gorillas, concentrated there because of the dry season, the "experts" will deduce that the *unknown* total of gorillas in the entire rain forest will be the number they have counted multiplied by the more-or-less *known* number of square kilometers comprising the area of the whole forest. In either case, the error is certain and considerable.

I am by no means an expert on gorillas. But in estimating their approximate population, I have kept in mind the risk of error presented by the preceding methods, as well as my own experiences of twenty years of travel through Ubangi-Shari, particularly the northeast of the territory, before coming to Gaboon and the Middle Congo. I have thus been able to form my opinions as to the number of elephants, buffaloes, Derby elands,



➤ **These gorilla hunters are employed by the government of the Belgian Congo to get young animals.**

They close in on a gorilla group in the forest. ➤

H. Goldstein-Congopresse Photos

lions, etc., in the Ubangi territory and in certain of its Reserves, studied sector by sector for greater precision. I have compared these opinions with those of the very rare whites who are competent in these matters. In this regard, it is unfortunate that there are as yet no Africans who could give a trustworthy answer to our question. I have extended this same method of probabilities, constantly checked and rechecked, to the gorilla, and it is my considered opinion that the gorilla population of Gaboon and the Middle Congo is at least 10,000 and no more than 20,000, with the actual figure coming closer to 10,000. My friend Charles Kieffer, Chief Game Inspector for the French Cameroons, in his *Le Grand Livre de la Faune Africaine et de sa Chasse* (1954), estimates the minimum number of gorillas in the forested zone of the French South Cameroons at 5,000 to 6,000. This figure is quite in accord with my own, for although the rain forest of the Cameroons is smaller in area than that of Gaboon and the Middle Congo, the density of its gorilla population seems to be much greater.

Is the gorilla population growing or declining? In my opinion, it is definitely on the wane, but not alarmingly so. The best-qualified hunter-naturalists such as my friend A. R. MacLatchy, Secretary-general and Chief Administrative Officer for the Territory of Gaboon, where he has spent twenty-eight years of his life, does not be-

lieve the gorilla was overhunted before its protection by law in 1932. I agree with him. But since that time new threats have arisen in the form of deforestation in the wake of timber and mining exploitation. Firearms are more numerous and the demand for young gorillas, even the skulls of adults, has also increased. What is more, for lack of enforcement machinery, protection actually exists on paper only. One of the gravest dangers is certainly the increasing number of capture drives organized either by professionals with few scruples as to method or by incompetent amateurs who "collect" the young. And slaughter



by natives left to themselves must increase in direct proportion to the availability of firearms (percussion-guns as well as modern smooth-bores). But I nevertheless still cannot accept the figure, presented at Bukavu, of a thousand-odd gorillas killed annually in the Middle Congo and Gaboon. Deaths are certainly less than half this.

I should point out, however, that there have been cases — fortunately not very common — of certain mining or forestry interests which, finding their meat in short supply, have not hesitated to send out their African hunters with orders to shoot gorillas to feed the labor force. Luckily, gorilla meat is not relished by many Africans. Far from it.

But even so, the gorilla needs all the luck he can get, for the state of his health, even in his natural habitat, is not always of the best. Captured animals, the adults at least, too frequently show morbid signs of skin and other diseases, internal parasites, accidents and battle-scars.

I think that the gorilla species, losing a little more of its habitat every year, always "at war" with mankind, annually gives ground slightly. It is therefore desirable that the international protection offered the animal be reinforced rather than weakened.

Having thus frankly set forth my opinion on this point, it is easy to understand why I can never approve the decision taken by the International Conference of Bukavu (Belgian Congo) in October, 1953, transferring the Lowland Gorilla from Category A (completely protected by the International Convention of London, 1933), to Category B (partly protected).

Because of the situation outlined earlier, it is no doubt inevitable that some gorillas be destroyed each year as undesirables, more because of their damage to agriculture than their attacks against men. And it is normal that these reduction measures be confided to competent men such as those of the Game Service. But in view of the underdevelopment of this Service as well as the problems of transport over long distances, a delegation of powers is perfectly conceivable. Under strictest control, amateurs paying a very high fee for a hunting license could be invited by local authorities to remove a specimen of gorilla that

last thirty years has seen fit to protest the slaughter of thousands of female elephants and their calves in defense of the crops of Uganda, Kenya or Tanganyika (Rhodesia is a different matter). And yet these elephants have also been specifically protected by Class A for twenty years as "bearers of tusks weighing less than 5 kilos." The *legitimate* interests of mankind must always take priority over those of animals. In the case of gorillas, there would doubtless be occasional removals by sportsmen rather than officials of the Game Service. There is a danger here, true, but no more than a few dozen specimens annually would be involved. The high fees for hunting licenses, the difficulties of the terrain and the presence of legal control should be sufficient to discourage the influx of amateurs in force.

On the other hand, if the gorilla is ever settled for good in Class B, he risks becoming fair game like the elephant and the Derby eland, less carefully watched over, exposed to greater dangers, particularly in the matter of capture and sale of the young. Everyone who knows the country I am discussing can imagine what manipulations and traffic would spring up. That is why I think the Bukavu decision was inopportune, even from a simple psychological point of view.

But to end on an optimistic note, I believe that in spite of everything, the gorilla is too well known and too much in the international eye for the species not to be able to look forward to many more long years of existence, shielded by the greatest protection of all, by a natural safeguard that favors him above other animals — a habitat particularly propitious to his conservation.

◆ **Low nets more or less completely encircle the group to ensnare any gorilla attempting to charge.**

➡ **This little Mountain Gorilla ran into the net.**



has become dangerous. As these individuals are almost always solitary old animals camping on the fringes of some village, the species would be none the worse for their loss. But this set-up could function while leaving the Lowland Gorilla in Class A. It is a simple matter of organization.

Except for the ill-informed or fanatics on the subject of game protection, nobody during the



THE GRAY December day gives little evidence of life. Bare maples, their limbs mantled in snow, rise above a white blanket that softens the earth's contour. Yet a few months ago, animal life was everywhere. Each field had its fat Woodchuck intent on a repast of clover or apple drops. The great brown Monarch Butterfly, gliding over the aster-covered fields, gave promise of long warm days ahead. Muddy

of Chickadees, Nuthatches and querulous Jays, while elfin tracks in the snow or subnivean tunnels proclaim that some mammals are still abroad, active but unseen. Life is muted, and one must search industriously to find even a few of the many scores of common species so abundant a few months earlier.

How do animals overcome this hostile period? Some, of course, do not; they are creatures of the

Where Do Animals Go in Winter-time?

By WILLIAM J. HAMILTON, JR.
Professor of Zoology, Cornell University



banks of drying ponds were lined with shorebirds feeding voraciously on the myriad small fry that swarmed in the shallow water. Night brought the bats in dexterous flight to devour the insect swarms, while underfoot toads fattened on noisy crickets.

But seasons change. Cold October rains shake off the remaining leaves and beat the insects to their death. Skim ice soon fringes the woodland pools and stills the life within. Lowering temperatures chill the ground and lock the waterways. Winter is at hand, and the once-abundant life departs. Where has it gone? To be sure, a walk in the winter woods will reveal little troupes

summertime and their spans of life are short. But as for the others, if winter brings a scarcity of food, they must either migrate to areas where there is a dietary to their liking, or pass the winter in dormancy or the death-like stupor of hibernation.

Even in periods of deep snow some species are able to secure a sufficiency of food. The deer, fastidious in its feeding on its nightly forays, utilizes the browse that rises above the snow or nibbles the tips of twigs. Cottontails, too, peel the bark from low apple branches as the white drifts bring them within reach, or chisel off the wild blackberry canes, eating the sharp thorns

and all. Foxes stalk the rabbits, or dig out the field mice when late winter thaws expose their nests. In the forest floor tiny shrews thread through the leaf mold gleaning the dormant insects, spiders and pillbugs. Under the ice voracious pike are active, pursuing the smaller perch which in turn prey on the hapless minnows. High overhead the Porcupine gathers in the hemlock twigs and girdles away the resinous bark, immune to the subzero nights of January. Its thick coat and tough hide are sufficient protection from the most frigid weather. It may remain in a single tree for several days, eventually backing

dack pond by a foot of ice, has wisely prepared for this bleak season. Stored in the deepest water of the pond, usually between the dam and the great lodge, is a pile of aspen or alder laboriously gathered during the fall nights. It leaves the lodge, gathers a branch from the cache and swims back to the dark recess, where it leisurely strips the bark with its great orange teeth.

Many creatures, perhaps less adaptable, must flee the rigors of winter and settle in a more amenable climate where food is not wanting. No end of our common birds leave the northern states, often to journey many hundreds of miles,



down and waddling through the snow to the rocky den that shelters others of its kind.

Other winter residents are more provident and have made a cache of food, as busy during the late summer as a farmwife with her jellies and jams. The Gray Squirrels of the Bronx Park, quite as interesting as any of the exhibition beasts, have patted down the fallen mast in the leaf litter and can resort to these delicacies when a diet of buds becomes tiresome. Chipmunks cram their cheek pouches to bursting, carrying seeds, beechnuts and corn to their underground labyrinths until a peck or more has been stored for winter use. The Beaver, locked in its Adiron-

resorting in an area where food is not a problem. Some bats, notably the Red, Hoary and Silver-haired, make extended trips, a few actually reaching the hospitable shores of Bermuda. Less marked are the shorter migrations of the Leopard Frog, some salamanders and other amphibians, from the fields and woods to the ooze of the pond bottom or the rubble of brooks.

Not a few animals, including insects, molluscs and the vertebrates, overcome this rigorous period in a manner simple to them but so complex and difficult to understand by man. These animals endure the long winter by hibernating. Hibernation involves an inactive state in which



Rolled into a ball of fur for its winter sleep, the Chipmunk nevertheless awakens at intervals to forage in the world of snow and ice above its den-site.

Photo by the author

Under the ice a beaver in the Jackson Hole region of the West has gathered aspen and alder to provide food in the winter days.



metabolism is greatly lowered, resulting in body temperatures a little higher than that of the surroundings. Many animals pass the winter in this profound "sleep," so marked that when handled they appear all but dead.

Consider the familiar Woodchuck. All through the summer and the early fall it has feasted well, adding to the thick layer of fat that swells its new coat. The chuck, be it an oldster or one of the growing young that have long since wandered from the natal den, is replete with the largess of the harvest season. The rains have

brought new succulents to the fields and the groundhog should know the delight of banquets before cold weather sets in. Disregarding the somnolent days ahead, the fat fellow makes its way to a nearby hedgerow or bordering woodlot and there refurbishes a long-unused burrow. Dead grasses and leaves it carries to the subterranean chamber, and begins a slumber that will continue for months. When it awakens in mid-February or early March the marmot re-appears in a barren world. A snow-covered pasture or desolate fields offer a bleak welcome, for the

strengthening sun has yet to push the green sprouts above the frozen soil. Almost five months have passed since the marmot has seen the sky. But like so many of its relatives, the western ground squirrels and their kin, the chuck has been immune to the winter storms that howled above. Winds that blew white drifts into the burrow have only sealed the life within.

In its snug retreat, profound changes commence even as the fat creature slumbers into its long winter night. As air temperatures drop, the chuck responds, its own body heat lowering to only a few degrees above the temperature of its surroundings — around 50° F., perhaps. Circulation is so retarded that little pulse can be found, a few beats per minute creating enough circulation to sustain life. Respiration is scarcely marked and breathing is evident only to a patient watcher. Head thrust between hind limbs, black fists knotted beneath the breast, this furry ball is ensured of another daisy-spattered meadow by its ability to sleep while others perish. At long last the broken rivulets coursing the valley slopes

proclaim the end of winter. The chuck appears above ground, its store of fat reduced but still sufficient to maintain it during the weeks of scarcity. The mating season is at hand and tell-tale tracks in the now dirty drifts give a clue to the Woodchuck's wanderings.

Our native jumping mice are also true hibernators. Although their food habits are similar to those of other small rodents which are active throughout the year, these long-tailed mice pocket themselves in a snug ball of dried leaves and grass by mid-October. A bunch of frozen fur scarcely the size of a golf ball, *Zapus* sleeps away half the year. Its huddled body, so rigid that it can be rolled across a table, appears quite without life, and Redwing Blackbirds will have settled in the northern marshes before this little fellow ventures forth again.

When the snow is not too deep and the elk can reach a grove of aspen such as this, they peel the succulent bark from the tree-trunks. These trees have all been stripped by hungry elk.



To visit the winter bat roosts, one must journey to the caves of the northeastern states. In these sanctuaries hundreds, often thousands, of bats cling to the limestone walls and ceilings. Temperatures in these winter quarters seldom drop below 45° F. In the smaller caves, often little more than fissures just large enough to permit one to squeeze through, the little Pipistrelle is likely to be bathed in the moisture of ever-present seepage and to appear like a beaded ball in the ray of a flashlight.

Hibernation is a misused term, frequently applied to any creature that becomes quiescent for varying periods during the winter months. It is well to differentiate between this major physiological change and the less profound one called dormancy. Dormant animals may become quiescent for several weeks or longer during the winter, yet appear to be in deep slumber. Witness the Black Bear. It may select an open swale or the scant cover provided by a few low spruce boughs. More often the she-bear chooses a great upturned root, scraping away a few bushels of dirt to conceal herself. Her pulse beats strongly and her breathing is scarcely less regular than on the August nights when she fed on grubs, fruits and other bounties of summer. The larger male that has fathered her unborn cubs is still roaming the ridges, uncovering the acorns and beechnuts scattered in the matting leaves. Skunks and Raccoons, rounded by the blanket of fat that

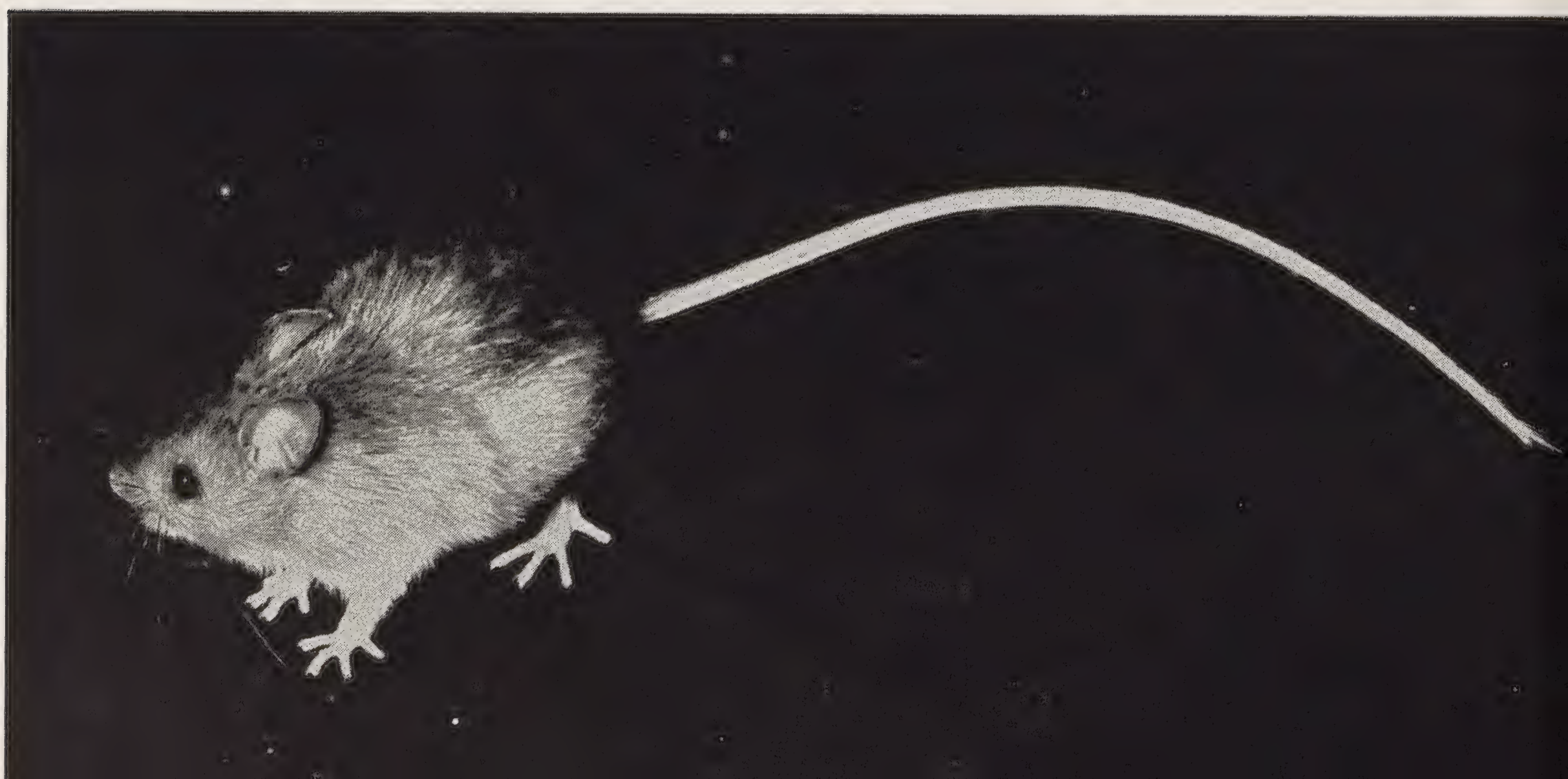
Jumping Mice pass half the year in a state of lethargy, yet their diet is about the same as that of Deer Mice, which are active in winter.

Photo by the author

helps sustain them in the frozen world of winter, slumber away in some burrow or rock fissure. They, like the bear, maintain a high temperature and are up and about in the milder spells. Following the open spring runs, the 'coon on January nights paws away the detritus, finding night-crawlers and fat insect larvae in the sodden matrix of the rivulet.

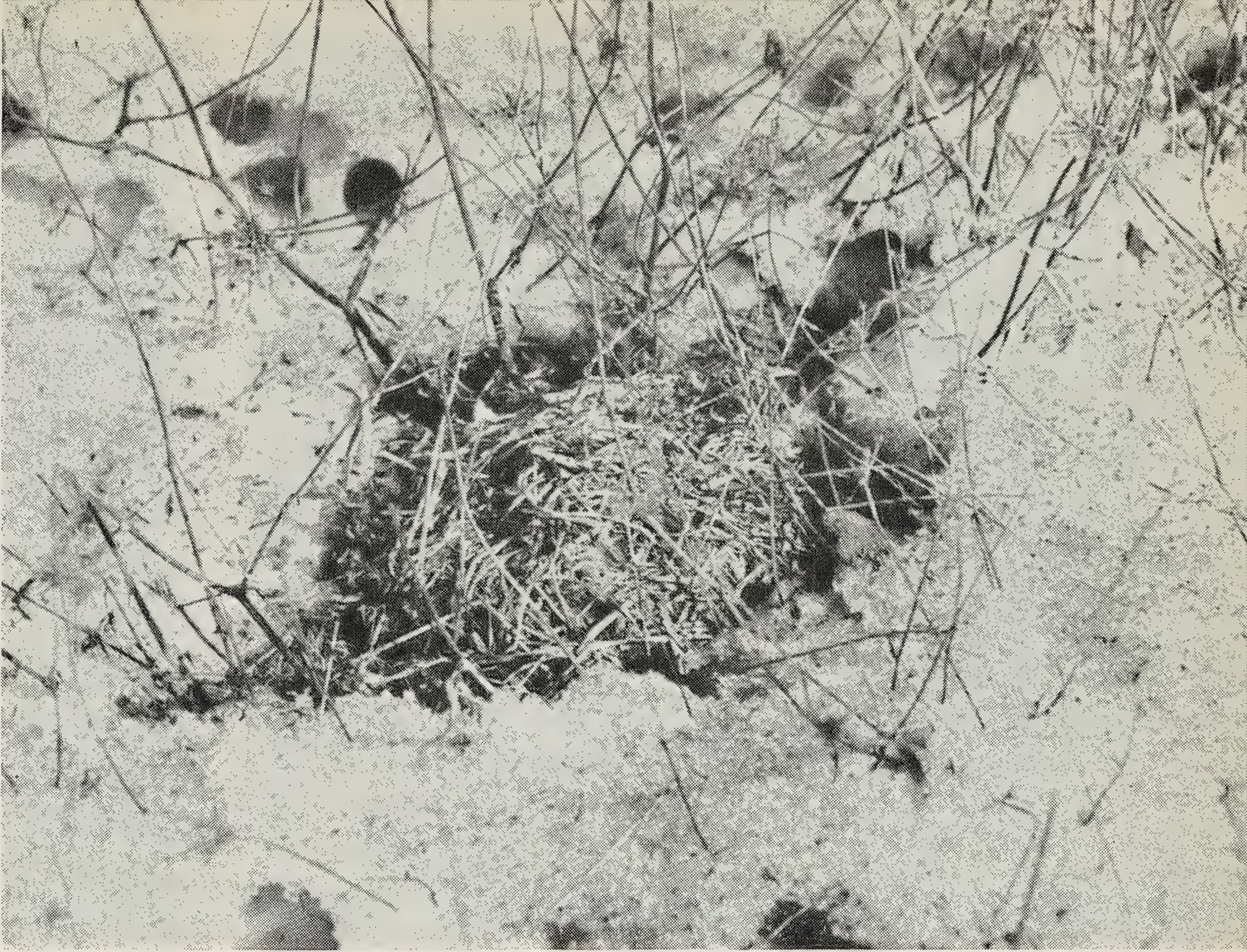
Toads are quick to respond to the first heavy frosts. Bufo scrapes away the dirt with the horny trowels of its hind feet and backs into the earth, digging deeper and yet deeper as frost penetrates the upper levels. The hind limbs are drawn against the belly, the fore legs pressed against the bowed head and the eyes are tightly closed. Here it rests in its earthen cell for half the year. A warm April rain softens the soil and the males push out into the spring night, to make the succeeding days ring with their high-pitched, musical trill.

In the northern states our native snakes all hibernate. Usually they associate in some numbers with their own kind, although different species may occupy the same winter chamber. Large ant hills are attractive sites and aggregations of Garter, Red-bellied and Green Snakes totalling 257 individuals have been taken from one such mound. Thirty-five years ago a school companion and I journeyed into the Ramapo Mountains near Suffern, New York, to collect rattlesnakes for Dr. Ditmars's collection at the Bronx Zoo. We usually visited this area the first week in May and early October when the snakes, just leaving or entering their winter quarters, were grouped about the entrance to the rock fissures. Blacksnakes and Copperheads resorted



This well-woven nest of a Field Mouse has been exposed by February thaws. When this happens, the mouse must leave to find sanctuary somewhere else.

Photo by the author



to the same den site, entering the stony outcrops with the rattlers. Even the great Diamond-back Rattlesnake of Florida retreats to a Gopher Turtle burrow as cool weather approaches, passing several months in this subterranean chamber.

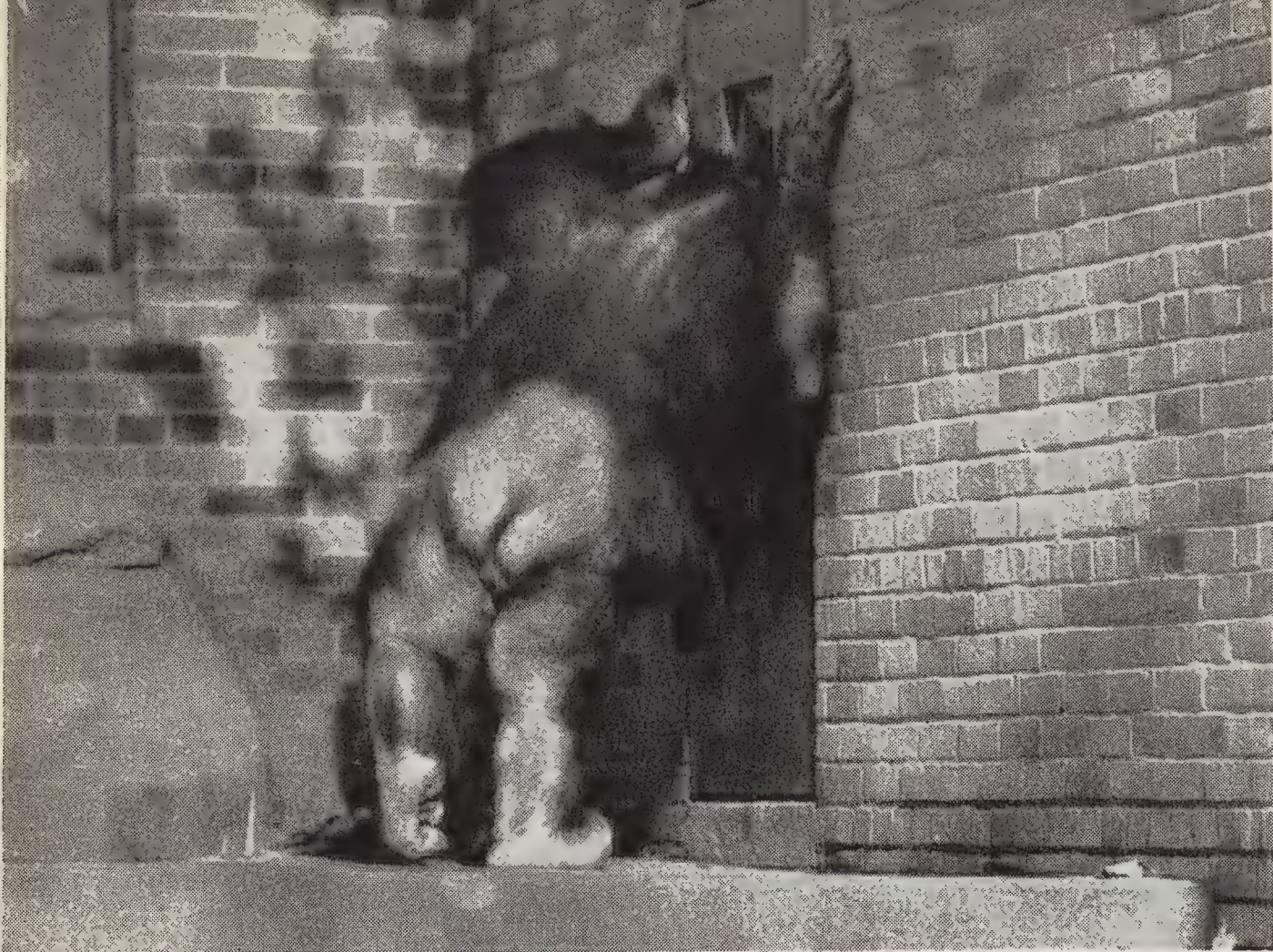
Near my home in upstate New York a spring, enclosed by a cement wall, provided a source of study for several years. Fallen leaves and mud filled the bottom and a few inches of water covered the detritus. Each year a few Garter Snakes assemble here to pass the winter. At least some of them return to this site each year to find refuge in the warmer temperature of the spring. People who have a wellhouse or a deep spring will find much of interest in and around them during the winter months.

The teeming populations of western Ground Squirrels do not wait for cold weather before disappearing. When summer heat and dessicating winds pass over the green vegetation, lack of moisture — and other factors — impel the squirrels to leave the bright world above and burrow into the ground. They do not reappear until seven months later when the waning winter still locks the ground in frozen silence. Aestivation, as summer torpidity is called, is a condition which appears to have evolved as a means of escape from the shortage of the food brought on by drying of the vegetation. Here the aestival slumber and winter sleep merge imperceptibly.

One might suppose that the winter sleepers would come out thin and emaciated. Certainly

some species lose weight during the long sleep, often as much as 40 per cent. of their initial weight, but since so many re-appear while cold weather still grips the land and food is at a premium, they must still depend on the hidden reservoir of fat to sustain them until new forage is available.

It is unfortunate that so many naturalists, amateur and professional alike, put away their field glasses and notebooks with the first snowfall, in a measure emulating some of the animals we have discussed. All too often field observation is not resumed until the first peepers proclaim the spring. Nevertheless, winter can be an enjoyable and profitable time of study for the naturalist. We yet know little of the ways of turtles, frogs and snakes during their long quiescent periods, and even less of many of the commonest small invertebrates that teem in the forest litter or ice-capped ponds. A full account of fish life in the deep retreats of ponds and lakes has yet to be written. Problems by the score remain to be investigated. Put aside, for a change, the bird glasses and the census-conscious study of avian life, and look underfoot for the dormancy of animal life under the crusted snow. I would even say: if you like this idea of serious winter study of natural history — if you think there are problems you could work out — drop me a card about them. I might be able to pass on some helpful suggestions, and I certainly would be interested in your results.



1. 'ANDY HEARD HIS KEEPER COMING.



2. KEEPER MICKY QUINN PRESENTED THE BAG.



3. THE GESTURE OF COVERING AND UNCOVERING

IN THE BAG WITH ANDY

PHOTOGRAPHS BY SAM DUNTON

The fierce possessiveness that some children have for a particular blanket or towel or bit of cloth is well known; they can comfort themselves endlessly with the soft, flexible object; they may even refuse to go to sleep unless they are permitted to have it with them. Other young primates—monkeys and the anthropoid apes—share this trait. Human children normally outgrow it; so, indeed, do young anthropoids, as far as emotional reliance on the object is concerned. But, unlike children, they may keep persistent interest in “childish” objects for many years—until they are, in fact, approaching middle age. Perhaps even longer. This long preamble is merely to say that **ANDY**, our usually lethargic **ORANG-**

UTAN, is still addicted to play with a cotton bag. The pictures on these pages tell the story and comment is hardly needed, except to say that from his earliest days with us (Andy came to the Zoo in 1947, at the age of 18 months, the first post-war Orang-utan to come out of Borneo) he has delighted in pulling a bag over his head. Now, at the age of about 10 years, he still gets evident enjoyment out of it. His fun is somewhat complicated by the fact that a young female Orang-utan, **SANDRA**, shares his compartment in the Great Apes House. Sandra has never been a bag-addict; at any rate, Andy has never permitted her to play with one. The best toys and the best food invariably are preempted by Andy himself.



FOR MANY MINUTES.



4. HIS TOES PULLED THE BAG DOWN SNUGLY.

SANDRA HAD BEEN WATCHING FROM A DISTANCE; NOW SHE CAME TO INVESTIGATE.





6. SANDRA SAW A CHANCE TO GET IN A FEW GOOD LICKS.

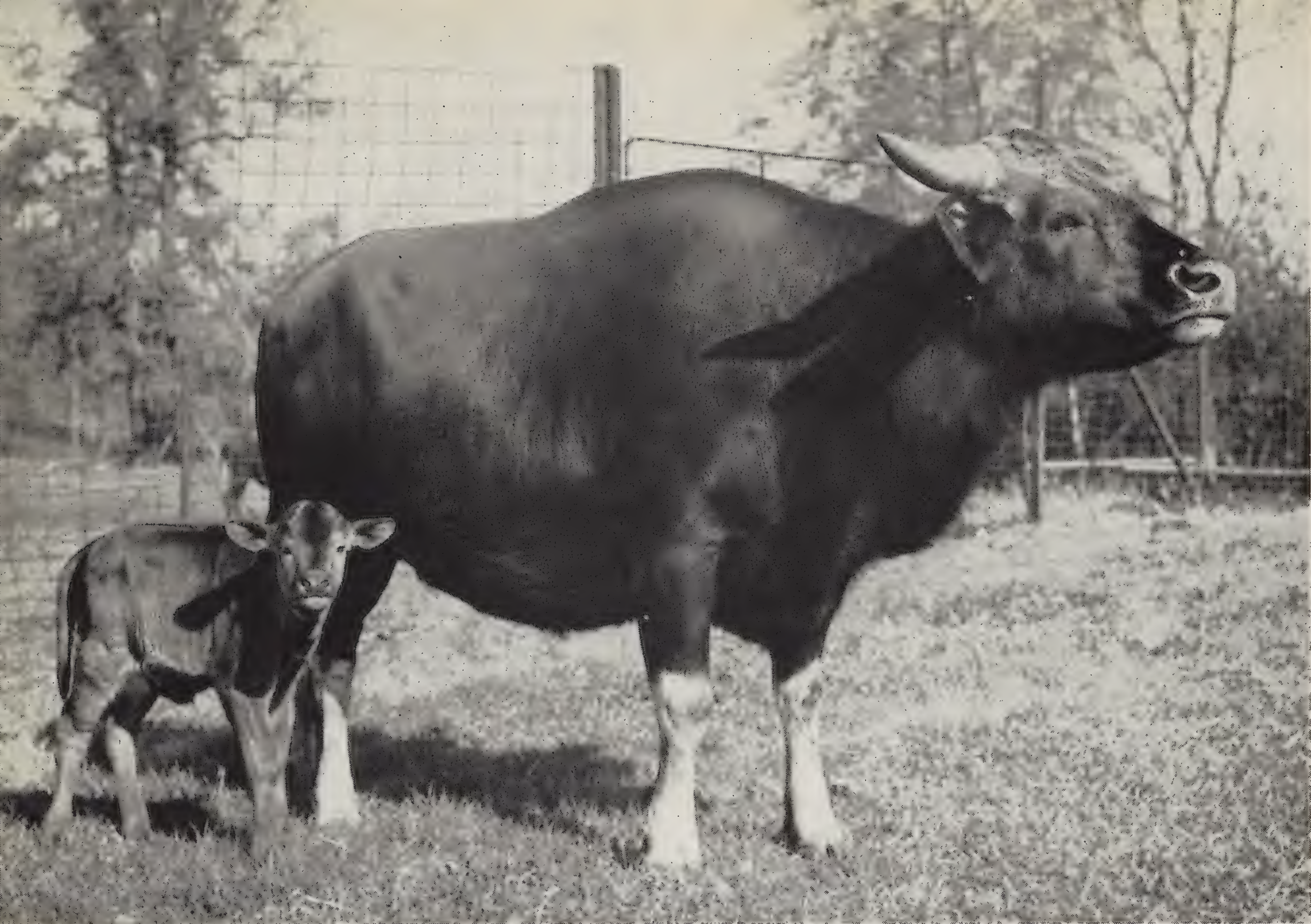
7. AND PUNISHMENT FOLLOWED, SWIFT AND SURE.



NEW ARRIVALS & NEWS

This picture shows a crucial moment in the life of young **JESSE**, our new **GRANT X CHAPMAN ZEBRA**. At the moment this photograph was made, Jesse was making up his mind whether it was safe to stroll out on our African Plains. For four weeks he had remained inside the corral, wandering to the gate occasionally and looking out but not venturing into the open. This morning he looked — took a few steps forward — and the adventuresome deed was done. Nothing jumped at him; nothing frightened him. New York, after all, proved to be just another place where the food is good and plentiful. Today, a month later, Jesse is perfectly at home on the Plains.





For all their impressive bulk and the sturdiness of their horns, **GAYALS** from the hill districts of northeastern India are steady, dependable, all-but-domestic animals. They have a strong "family feeling" and our old bull, the sire of this frolicsome calf, is generally tolerant of his offspring and sometimes even playful with it. This youngster was born on October 22 and is the latest in a succession of calves we have had from our breeding pair. Calves are often distinctly reddish at birth but their coat gradually darkens to the glossy brownish-black of the adult. This particular calf is a male and its coat is grayish.

For four years in succession we have had a baby **GUINEA BABOON** from a pair in our Primate collection, and the female and her offspring of 1955, 1954 and 1953 are on view here — the latter two at least partially on view. They were full of curiosity about the photographer, but are still young enough to be timid and want to hide behind their mother. The 1952 youngster has been removed from the family temporarily for special diet in our Animal Hospital. Breeding pairs of Guinea Baboons are not common in zoological collections.



This is how you decorate a **KOMODO MONITOR'S** compartment. We learned how this summer when it became necessary to replace the natural vines in the back of the monitor room with artificial sprays. William Allen of our Maintenance Department undertook the simple job of tacking the sprays in place, but it took the constant and often combined efforts of Curator Oliver and Headkeeper Spencook to keep the male monitor from trying to climb up Mr. Allen's back. The reptile has never made an attempt to bite, although a few times it has lashed out with its heavy tail when annoyed. The climbing which it likes to do, while not meant aggressively, is dangerous on account of the sharp claws on the fore and hind feet. The monitor never gave up trying while Mr. Allen worked. The female just slept.



Zoo-goer in Asia

By WILLIAM BEEBE

SINGAPORE ITSELF has no proper Zoological Park, but the simian population of the Botanical Gardens more than compensates. On July seventh, 1955, I left the car at the gate of the Singapore Botanical Garden and started up Palm Valley. Two dead leaves drifted down upon me, followed by a monkey which landed lightly almost upon my shoe. He backed a yard away, sat down, and began to eat grass, paying not the slightest attention to me. Within a minute he was followed by fourteen more primates, including two large males and eight females with babies clinging to their fur.

As in many another situation, I considered the present tableau which had crystallized without warning, and realized I could qualify as a Coward, First Class. In past years I have been threatened by gangs of baboons, and I did not care for the nonchalant proximity of those two dozen understudies.

I instinctively took out a small notebook and at once became the center of interest. From the fixity of attention of the fifteen pairs of mean little eyes on the white paper, I gained confidence, and realized that they were only waiting for a handout. The scene changed and I saw myself in the Bronx Zoo, with a bag of cracker-jack, surrounded by fifteen gray squirrels. I heaved a sigh of relief and broke the circle. I have had many experiences in a Zoo, but this was tops.

Ten feet away a mother monkey leaped for a low-hung fruit and accidentally stepped on her offspring, which let out a screech. Instantly the biggest male looked at me and bared his dog-teeth. The potentiality of danger was there, as I later heard from an English woman. Her fox terrier slipped his leash in the Gardens, and seized a baby Macaque. In a moment he was attacked by the whole band and killed.

One half-grown monkey had only the stump of

a tail, giving him a superficial resemblance to his big jungle brother, the Pig-tailed Macaque. My sympathy was short-lived, for I remembered the non-prehensileness of this organ. When four monkeys were seated on a branch, rear-on, close together they recalled Kipling's slogan of the Banderlog, "Brother, thy tail hangs down behind!" Kangaroo-like, the tail serves as a prop when they occasionally stand upright to peel a fruit.

Another day I joined a little Chinese bride and her husband, and we fed a band of forty-seven. In the center of the road they formed a semi-circle, younger ones in front. The little hands would reach out and snatch the nuts, whereupon it was a question whether they could chew and swallow before their parents reached them, to scoop their cheek pouches clean, leaving their infuriated infants to go back and try to snatch another morsel. This recalls the habit of our South American cebus mothers, in paying out their offspring by their tails, enabling them to pluck berries from slender twigs which would not bear the weight of their parents.

The present Director of the Gardens, Dr. Purseglove, detests the monkeys as much as the visitors adore them. They have never been caged but have worked their way into the grounds in the past from out-lying woods. It is exceedingly difficult to keep them down to reasonable numbers for at the sight of a gun all vanish, and they usually hold their food in their cheek pouches, which gives them opportunity to detect poison before swallowing it. They do much damage to the animal life and the most valuable plants such as orchids must be guarded by electrified wire fences.

One of the first monkeys to touch the fence was an old male who snatched his hand away at the shock. Then, in a towering rage, he turned and went for his fellow monkeys, apparently



blaming them for the new and unpleasant experience. In most cases a single shock was sufficient to keep them away.

On the last day of our stay Miss Crane and I went to the Gardens for photographs, and heard that three of the largest and most aggressive males had been shot two days before. Instead of being wary, the bands were tamer than ever. The full-grown males had always been the least friendly and now that their warning barks were no longer heard, the rank and file accepted handouts of chocolates and peanuts with utmost abandon. For example, a large female with her infant at her breast, climbed into my lap with the young monkey between us. The baby's eyes were closed, its fists tightly clenched, and it squalled loudly. At the same time the mother seized a chocolate with her free hand and leaped to the ground, slapping her offspring back into place.

It is the large Pig-tailed Macaque which is used to pick coconuts. Now and then a bicyclist can be seen with one of these monkeys riding in the provision basket. He is en route to some village to which he will rent self and monkey. The ani-

Dr. Beebe found that Singapore's macaques have much in common with New York's Gray Squirrels; both enjoy begging from visitors. But macaques have very uncertain tempers.

mal ascends on a long leash and twists the nut until the stem breaks. Curiously enough, he does not use both hands or both feet at the same time, but those on one side, right or left, holding tightly with the opposite hand and foot. He is most expert in returning along the line and freeing it from obstacles, but, lacking a prehensile tail, he cannot hold the leash aloft and free, as do our Chiris in Trinidad.

The nearest zoo to Singapore was that of the Sultan of Johore, which was just this side of a "black" zone of terrorist activity. We went north along the main highway of the island, across the famous causeway and on to the old palace and park. Here we found a large wire enclosure with fruit pigeons, gallinules, three ducks and a pair of Argus Pheasants in the underbrush.

Not far away we found the Sultan's proper zoo, to enter which we paid one dollar and a quarter,

about forty cents American. On a hillside was an irregular jumble of cages with great stone walls, fronted with needlessly stout bars or close-meshed wire. The fences were composed of metal sections of air-field runways, punctured with a multitude of round holes. A pleasant Malay keeper showed us around and offered to let us go into the cage with two nearly grown tigers. He said they were born in the zoo and were usually tame. We politely refused.

A three months' old Honey Bear had an orange throat ring and as I held him he sang as he sucked his paws, exactly as did the Bornean bear "Kapit" which I sent to the Bronx Zoo almost a half century ago. A nearly grown Orang from Sumatra was hastily encumbered with shirt and sarong, and came to us and fingered our camera, and we made our manners and tried to be appreciative. The best animal was a wild dog, the size of a small fox, with erect ears lined with long whitish hairs. It was reddish brown above, with white lips and underbody, and the tail was long with a well-marked black brush. My offer to purchase him was discouraged.

Two baby elephants were the hairiest I have ever seen, suggesting what infant mammoths must have looked like. The sea-eagles and cassowaries were especially fine. There remains only to mention the labels. These were eight by

twelve inches, with the upper half completely filled with the legend in large letters, DRINK COCA-COLA. Then TIGER in small script, in English, Malay and Chinese.

My last zoo was the smallest, newest and most generous. It occupied a single room in a disused building near the Royal Air Force flying field. Flight Lieutenant G. C. Morton had interested the fliers and their families in a Natural History Club, and they had cages and labels and all the props of a regular zoo. In addition, they possessed boiling enthusiasm which was a joy to see. The collection included a Macaque and a Slow Loris, turtles, pit vipers and four flying snakes. They generously presented two of these interesting snakes to the Zoological Society — long, slender serpents, brownish-green and mild in character. The pair ultimately arrived safely in New York and are on exhibition in the Reptile House. So, after all, Singapore has an embryo pukka zoo.

* * *

THE zoo at Colombo, Ceylon, or Dehiwala, as it is known, is the largest and perhaps the best kept of those which I visited in the East. Like

The Sultan of Johore ingeniously utilized sections of air-field runways to confine the exhibits in his collection. Labels were in English, Malay, Chinese — and modern advertising!





our own Zoological Park it is a considerable distance from the city, and occupies a diversified landscape of hills and dales. The architecture of the cages and enclosures is massive and oriental in character, abounding in spires, minarets and arabesque ornamentation. In some cases the inmates seemed, in comparison, incongruously small and inconspicuous, but they more than made up for this in numbers and in excellent condition and health.

The stork and adjutant aviary was surmounted by four columns of cement and upon each was a sculptured stork, lifesize and in color. For minute after minute I was lost in admiration at the exquisite detail, when suddenly one of the four spread its wings, and the others began to preen. The quartet of nearly grown storks had been reared in the zoo, and had fooled many visitors as they took motionless siestas on the capitals.

The zoo was unprovided with guide-books, owing to the low percentage of literacy among the visitors, but labels were adequate and accurate, provided with titles in English, Latin, Singhalese and Urdu.

The Director, Major A. N. Weinman, was a

Markets in the larger cities of the East were full of fascinating mammals and birds. In this one merchants offered cockatoos, lories, parakeets and parrots, occasionally rare species.

man mighty in physique and great in affection for his charges. A remarkable number of the host of birds and mammals recognized his step or himself as he approached. His pockets bulged with choice morsels of food, and he had a friendly greeting for tiger and civet, barbet and lory. Even cold-blooded creatures were his familiars: witness the valedictory label concerning the murder of Henry the Crocodile!

The shattered skull was put on exhibition and the tragedy reported as follows: "Henry was the best 'croc' at the Dehiwala Zoo. But visitors to the gardens did not appreciate his bigness or his magnificence as a specimen of his kind. Instead they were more concerned whether the big crocodile in the pit was asleep or awake. To satisfy their curiosity they threw large rocks at his head. Henry bore the torture stolidly but he could not keep it up for long. He died of fractures in his cranium — some of them three inches in length."

Today there is a new croc in the pit which was Henry's home for nearly a decade. And on the wall above the pit hangs Henry's skull with the legend YOU KILLED HIM! — written in red ink — BY STONE THROWING. PLEASE SPARE THE OTHERS.

The Director proudly showed us a pair of great, Papuan Black Cockatoos, a flock of Spurfowl and several families of Ceylon Junglefowl. These latter breed readily, hatching four to six chicks each season. The Javanese species is lacking, owing to disturbed political conditions.

As we walked along we occasionally met a man with a shotgun, on his rounds, in case of the escape of a dangerous animal. Once Weinman whispered to an unconfined Green Barbet, whereupon it lowered its head, and in return, whispered an amazingly sweet, chattering song. In one cage, five small, iridescent kingfishers were perched in a row on a horizontal branch. They were waiting for the liberation of one small fish at a time, one after another from an ingenious water trap, whereupon first one, then the next bird dived and caught its fish. The zoo walk furnished one surprise after another.

It speaks well for elephant conservation in Ceylon that after hundreds of years of close association with Veddas, Singhalese and British these animals need thinning out to prevent their interference with man's industries and life.

Forty-five years ago in January, 1910, I had a vivid personal experience of this at first hand. I entered into the life history of this terrestrial behemoth by way of an irate mother elephant and her small calf. While I was stalking Ceylon Junglefowl in the Yala Sanctuary in the south-east part of the island I was treed by this annoyed parent. Rooted, would be perhaps a better term, for I sought sanctuary between the buttresses of a giant tree. For what seemed an eternity the great beast reached for me with her trunk tip, while her offspring squealed and frisked about. Her breath was heavy with the odor of sweet grass and my lasting memory is of a dollar-sized patch of bright green leaf plastered to the center of one of her ears. Although she kicked my gun and camera about, they took no harm, and when she finally left, I tremblingly emerged from my burrow, also all in one piece.

After nearly half a century, September, 1955, while walking along a path in the Colombo Zoo I was almost knocked over by a sudden shove. A Zoo keeper tearfully begged my pardon for his action, but pointed out the nearer of two elephants which were walking along the same path. They were roped together and the viciously swinging trunk and the expression in the blood-shot eye of the smaller elephant left no doubt of what would have happened to me if I had come within reach of his proboscis.

I found that elephants were Major Weinman's especial enthusiasm and concern. So destructive had the wild Ceylon Elephants become, destroying crops, threatening natives and injuring the Shell oil property, that the latter Company had asked for permission to shoot sixteen. The government had referred the situation to Major Weinman, head of the Zoo. Under his direction five elephants had already been captured, and the others were being rounded up. My assailant had been wild and uncaught four days before. The mahout raised his ankus and the pair of elephants — the wild and the tame — moved slowly down to the edge of the pond for their bath. The co-operation of the tame animals in aiding the capture and control of their wild fellows was, as it always is, the factor of supreme interest — tempting the use of the word intelligence.

As Major Weinman and I walked past the civet enclosure he gave a shrill blast on a whistle and almost immediately there loped into view a baby elephant. He brushed close past me and came to a stop as the Major held up a banana. At the question "What will you do for this?" the small pachyderm immediately proceeded to sit down, rear up his forelegs and curl up his trunk (never taking his eyes from the fruit). "What about this?" and at the sight of the second banana, the infant Jumbo clumsily but earnestly stood on his head and earned his reward. As he ambled off I could almost swear that he turned and winked at me, which I interpreted as "What fools we mortals be!"

As Weinman gave the little fellow a farewell pat, I realized that in this impromptu circus, performed at arm's length, I had detected in both parties nothing but kindness, enjoyment and mutual friendliness.

News from the Conservation Foundation

Conservation Education — How Much and What Kind?

The study by Dr. Charles E. Lively of the University of Missouri of the scope and status of conservation education in the colleges of the United States has been completed and will be published in 1956. It discloses that approximately half the colleges in the United States now give no formal conservation instruction, that the most extensive conservation training occurs in the land grant colleges and the teacher-training institutions and the least in the liberal arts colleges of the Northeast and in junior colleges throughout the nation. Dr. Lively's analyses of course content and teacher attitudes and his evaluation of current conservation education are comprehensive and unique. It is believed that this report will give tremendous impetus to conservation education.

Request for Additional Studies of Jamaica's Population

On the basis of the preliminary reports that resulted from the Foundation's studies of population trends and resources in Jamaica, the Foundation has been urged by various private citizens and institutions in that island to continue and extend its research for another year. Preliminary financial support for such extension of research has been gained.

Water Law Symposium

Findings already made in the continuing study of the need for changes in water laws of the eastern states and problems which will have to be met in the enactment of adequate laws to meet increasing demands for water, have led to the calling of a symposium of legislators, administrators and water users, to be held early in 1956.

New Director — Industry Relations Has Been Appointed

Kenneth B. Anderson has joined the staff of the Foundation as Director — Industry Relations to assist the growing number of corporations now helping to support the Foundation's work to find opportunities for corporate activities which will improve conservation practice and benefit the corporations concerned.

Graduate Schools of Conservation

Since the Foundation helped to establish the Graduate School of Conservation at Yale University five years ago as a pioneer experiment in higher education, ten universities throughout the nation have offered graduate courses leading to special degrees in this field. Many graduates of such courses subsequently go into teaching of conservation or into government employment, and it is hoped that in the ensuing year, as a result of a special Foundation study, employment opportunities in industry will accelerate.

Adult Discussion Guides

In connection with the Conservation Radio Program to be sponsored by the Foundation and the National Broadcasting Company early in 1956, radio listeners on national hookups will be invited to request copies of a new Adult Discussion Guide being prepared to encourage public discussion of the major conservation issues of the day.

National Research Council

President Osborn is currently participating in the work of a special committee appointed by the National Research Council to review current research work related to natural resources and to plan ways of coordinating and extending such research.



'56 Will be a Great Year

Not just for Burgundies and Bordeaux, but for every member of the New York Zoological Society. With the new Aquarium opening in the spring, with all the new animals on their way to the Zoo, we will have more to offer our member friends than ever before. That's for sure. So give memberships in this Society for Christmas *now*. Make this present to all the animal lovers you know. Make it to yourself. Use the blank bound into this magazine.

New Members of the New York Zoological Society

(Between September 1 and October 31, 1955)

Life

Charles Kanuk
Adolf H. Rust

Contributing

Mrs. Walter Bareiss
E. Farrar Bateson, Jr.
David Berk
Gerald Eisner
Mrs. Florence R. Ferguson
Edward R. Gay
W. Hunt Hall
Roy E. Jones

Mrs. Robert McKelvy
James Bishop Peabody
George O. Schneller

Annual

Miss Frances Arnold
Mrs. Edwin DeT. Bechtel
Frank K. Bell
Mrs. Leonard F. Bouman
David A. Brody
Mrs. Robert M. Byrne
Dr. M. L. Giampe
L. J. Grant
Mrs. Phillip Haberman, Jr.

F. Raymond Johnson
Dr. Charles E. Jurka
Mrs. Iris D. Knight
Rufus H. Knight
Dr. Lisbeth M. Kraft
Mrs. Nicholas Longworth
Morton Nelkin
Miss Elaine M. Nickelsberg
Miss Ronnie Phyllis Orden
Rev. Everett C. Parker
Miss Mary G. Potter
Harry A. Russell
Mrs. Richard Seitz
Master Stephen Zuccaro

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

It's Officially Winter in the Zoo; the Platypuses Are Indoors

Cecil and Penelope, our Duck-billed Platypuses, were moved to winter quarters in the basement of the Lion House on October 29 to escape predicted early cold snaps. They will not be on exhibition until next spring.

It was, apparently, an easy summer for both animals, for they made slight gains in weight since last year's retirement time. Cecil weighed 3.828 pounds on October 29 of this year as against 3.608 pounds on October 27, 1954, a gain of .22 pound.

Penelope, always about half the weight of the male, was 1.848 pounds this year and 1.672 pounds on the comparable date last year, a gain of .176 pound.

The Duck-bills came to us from their native Australia on April 26, 1947. No breeding activity was noticed this past summer and we have less and less hope that the pair will reproduce.

IN BRIEF

Wolf, Gamma & Trinket. Three snakes with interesting and descriptive common names have been received from India as a donation from Saul Blickman, a member of the Zoological Society. A Wolf Snake (*Lycodon aulicus*) is so called because of its large, wolf-like teeth. The Indian Gamma takes its name from its spots, which resemble the Greek letter gamma. Trinket Snakes twinkle like ornaments and are often used by Indian snake charmers to attract passers-by.

Annie's a Father Again. The impossibility of distinguishing between male and female penguins by their external appearance led, a good many years ago, to the mis-naming of "Annie," one of the Black-foot Penguins in the collection of the Aquarium while it was still at the Battery. Behavioral traits observed after "Annie" came to

the Zoological Park in 1941 at last revealed that "she" was a male, but the feminine name has stuck and on the Bird Department's records Annie is credited as the father of the latest Black-foot chick, hatched this fall. Annie has been the male parent of most of our penguins hatched since 1944, many of them Black-foot X Humboldt hybrids.

Winter Closings. The Children's Zoo closed for the winter on November 13 with an attendance of 311,378, making a grand total of 4,372,074 children and adults who have entered to play with its young animals since the opening on May 21, 1941. The Farm-in-the-Zoo closed for the season on the same day, having had 90,686 visitors, a substantial increase over last year.

Hedgehog Record. Insectivores, generally speaking, have rather short lives and European Hedgehogs at the age of three years are well along in years. On October 7 we lost a hedgehog that had come to us on October 29, 1951; it established what appears to be a new longevity record for the species, of three years, eleven months and eight days — more than six months longer than the best previous record we can find.

An Onager Again. On November 14 we received through the interest of Bronson M. Potter, the second Onager (*Equus hemionus onager*) we have ever exhibited. Our first specimen, a female, was brought from Europe by Mr. Crandall in 1920 and lived here until 1937, producing during that time two foals by cross-breeding with our male Kiang. The offspring were called Kianagers. The new Onager is a six-months'-old male and is spending the winter in the Zebra House.

Surprise Elk. Elk calves are normally born in the Zoological Park in May, June or July, but on rare occasions they come considerably later. One was born on November 3 this year; the latest elk birth in our records is November 6.

PUBLICATIONS OF INTEREST

THE NATURAL HISTORY OF NORTH AMERICAN AMPHIBIANS AND REPTILES. By James A. Oliver. ix + 359 pp., 12 plates and 74 figures. D. Van Nostrand Co., Inc., New York, 1955. \$6.95.

In one sense this is a book for those whose time is limited but whose interests are not. An enormous amount of literature has been not only summarized but synthesized. Isolated facts concerning individual species are of intrinsic interest, but here they have been given additional meaning by virtue of their being fitted into a general picture.

During recent years a number of excellent handbooks covering the individual groups of amphibians and reptiles in the United States have become available. These were designed primarily for the identification of species and subspecies, usually with a few bits of information concerning the natural history of each. The better handbooks included summaries of general information, but on the whole their purpose was to answer the question, "What animal do I have?"

Assuming that you've obtained the answer to that question (or even if you haven't) you may be astonished to find that it is vastly more interesting to learn some of the amazing things that the common salamander, frog, turtle, alligator, lizard or snake is capable of doing. Often Dr. Oliver can tell you how these things are done, although there are, to be sure, many questions that remain to be answered. By comparing species, however, it is often possible to gain some insight concerning the forces of natural selection that have led to the diversities of structure and behavior encountered in any one group of animals. This approach has been successfully employed, augmented by 15 tables and many excellent figures that summarize facts discussed in the text.

The book is written in simple style with a minimum of technical terms, all of which are defined in a glossary. The amateur naturalist will find answers to most of his questions, but over and above that he will be stimulated

by the discovery that replies can be found for questions that he never thought of raising. Herpetologists will be delighted to find the useful tabulations and they will be grateful to Dr. Oliver for his instructive summaries of widely scattered information. They may lament the absence of citations and a bibliography although 11 handbooks and check lists are listed as references, and authorities are frequently cited in the text. The binder or printer was not particularly judicious in the insertion of the plates, one of which separates a figure from its caption.

But these are minor complaints. This is an uncommonly sensible book, well planned, well executed, readable, stimulating, and last but not least, with a complete and usable index. — CHARLES M. BOGERT.

NAT FEIN'S ANIMALS. Sixty photographs by Nat Fein, with text as told to Ferdi Backer and Ruth Biemiller. 96 pp. Gilbert Press, Inc., New York, 1955. \$3.50.

The Introduction to this book says Nat Fein is crazy. Sure he's crazy — like *Vulpes fulva*. This *Herald Tribune* photographer comes up to the Bronx Zoo quite often. You can hear him coming, from a long way off. He sheds picture ideas as a moulting chicken sheds feathers. He then selects, unerringly, the most preposterous, grotesque and revolting of these ideas and announces that he and his Picture Desk will be satisfied with nothing less than the Full Treatment on all of them. After a while he goes away, and in next morning's *Herald Trib.* you see the lower half of page one given over to a photograph that *compels* your attention because it reveals in stark simplicity some endearing or story-telling trait of animals. Down at the lower right it says in small type:

Herald Tribune photo by Nat Fein

Nearly a third of the photographs in this book were made in the Bronx Zoo. Others were made at pet shows, around town, just here and there when the fancy struck this ingenious and imaginative photographer. The text must have been taken down on a tape recorder; Nat's stories of how and why he made each picture are as true to life, and as true to Nat Fein, as his pictures. — W. BRIDGES

INDEX

Figures in **black type** indicate that the reference is to, or includes, an illustration, map or design.

A

Acinonyx jubatus, 134
Actinopyga agasizii, 160
Afropavo congensis, photos sent to Congo, **91**
Ailuroedus buccoides, 37
crassirostris, 37
Alouatta palliata, 104, **106-108**
palliata aequatorialis, **105**
seniculus, 105
Amblyornis inoratus, 36
macgregorii, 36
subalaris, 36
Angler fish, **102**
Anteater, Giant, **100, 114**
Aquarium, new, under

construction, **137, 138**
Archboldia papuensis, 36
Armadillo, Nine-banded, **82, 84-87**
Armstrong, Edward A., "The Adaptable Wren," 21
Aspen, barked by elk, **173**
Atz, James W., "The Fish with Holes in Its Head," 77
Axelrod, Herbert R., donates fish, 50

B

Baboon, Guinea, and baby, **180**
Baby animals, born in Zoo, 63
Bear, Black, cubs born, 62
family group, **Cover No. 3**
female and cubs, **80, 81**

Beaver lodge, in Jackson Hole, **172**
Beebe, William, "A Summer in Asia," 89
feeding macaque, **183**
in Johore Zoo, **184**
"Newsletter from Karachi," 135
"Zoo-goer in Asia," 182
Bergen, Stephen W., "All on the Theme of Conservation," 18
Bird of Paradise, Ribbon-tailed, **144**
Birds, population of, 72
Blancou, Lucien, "The Lowland Gorilla," 162
Blochman, Lawrence G., translator, 162
Boa, Annulated, **66**

- "Book of Beasts," 95
Books reviewed:
"Amphibians and Reptiles of Western North America," 63
"Aspects of Deep Sea Biology," 94
"Attracting Birds to Your Backyard," 94
"Bafut Beagles," 128
"Beast that Walks like Man," 160
"Bird Houses," 160
"Development of Color in Budgerigars," 94
"Dinosaurs," 94
"Doctor Jimek I Presume," 160
"Evolution of the Vertebrates," 128
"Greenhead," 160
"Marlin Perkins' Zooparade," 64
"My Zoo Family," 31
"Nat Fein's Animals," 190
"Natural History of North American Reptiles and Amphibians," 190
"Odyssey of an Animal Collector," 128
"Pet Hamsters," 160
"Prehistoric Animals," 94
"Saga of the Grey Seal," 128
"Stray Feathers from a Bird Man's Desk," 128
"Tigers of Trengganu," 32
"Vulcan, the Story of a Bald Eagle," 160
"Waterfowl of the World," 64
"World Outside My Door," 160
"Zoo Pets," 160
Bos gaurus, 2, **3, 10, 11**
Bothrops schlegeli, 69, **71**
Bower-bird, Brown Gardener, **40**
Fawn-breasted, **38**
Golden-crested Black, 36
Golden Queensland Gardener, 36, **41**
Great Gray, 34, **39**
habitat of, **42**
Satin, 35, **39**
Spotted, 34
Stagemaker, **43**
types of bower, **36, 37**
Yellow-breasted, **34, 35**
Bridges, William, "The Cheetah — the Mildest Cat," 130
Buchanan, G. Dale, "Nine-banded Armadillo — Invader from the South," 82
Burr, Andrew, Jr., 123
Bylot Island, expedition to, 56
- C**
- Callimico, feeding habits of, 91
new arrival, **15, 29**
second specimen, 63
Callimico goeldii, 29, 91
Cameron, Dr. T. W. M., presents Gray Seal, 29
"Candy," Asiatic Elephant, **140**
Carlisle, Donald T., "The Fable of the Sloth and the Cheetah," 139
"Spring Comes Along — Eventually," 47
Carr, Archie, "The Riddle of the Ridley," 146
Carson, Rachel, Gold medal recipient in 1953, 1
Catbird, Green, 37
Tooth-billed, 37
White-throated, 37
Chapin, Dr. James P., requests photographs, 91
Cheetah, **Cover No. 5, 131, 133**
pair received, 128
speed of, 131
Children's Zoo, attendance in 1955, 189
Chimpanzee, Black-faced, record weight, 127
new "Little Women," 93
Chipmunk, in winter sleep, **172**
Chlamydera cervinoventris, **38**
lauterbachii, 36
maculata, 34
nuchalis, 34
Chlamydosaurus kingi, **44-46**
Coates, Christopher W., "How's the New Aquarium Coming?" 137
Cobra, King, hand-feeding young, 159
handling technique, 93
hatching, **111**
incubation of, 92
Colombo, Zoo in, 184
Congo, fishes from, 127
Congo Peacock, photos sent to Congo, **91**
Conservation Foundation, books published by, 18, **19**
Adult Discussion Guides, 187
American Watershed Conference, 28
Arid Lands Conference, 90
Bighorn Sheep project, 62
Book on Jamaican population, 125
Booklet on Foundation, 28
Conservation achievement survey, 62
Conservation education study, 187
Conservation job survey, 61
Director — Industry Relations, 187
Dr. Graham abroad, 157
Eastern water law, 62
Education survey completed, 157
Fifty Years of Forestry, 62
Flood control study, 90
Geographical Conference, 28
Graduate Schools of Conservation, 187
Jamaican demography reviewed, 28
Jamaican studies, 157
additional study requested, 187
Junior Conservation Series films, 29
National Research Council, 187
Nicholson, Dr. Max, 125
Osborn, Dr., articles by, 125
Osborn-Davis paper, 28
Pan American Conference, 125
Radio program with NBC, 125, 157
Snider on editorial board, 29
Teachers' Handbook, 157
Television program, 157
Water Law study, 90
survey, 125
symposium, 187
Wenner-Gren Foundation Conference, 28, 125
Constrictor, Boa, gift, **68**
Crandall, Lee S., Bower-bird observations, 39
Crane, White-necked, injury to, **30, 31**
Ctenosaura similis, **69**
Cully, William T. A., letter from, 94
- D**
- Deer, Sambar, in Malayan salt-lick, **6**
relations with Seladang, 6
Dipsas variegata nicholsi, 70, **71**
Dunton, Sam, Fellow of B.P.A., 159
Zoo Pictures by, **15, 48, 49, 80, 81, 110-115, 140-145, 176-181**
- E**
- Eagle, Golden, "Mr. Ramshaw," 93
Elephant, Asiatic, "Candy," **140**
relations with Seladang, 8
Elk, Jackson Hole, **Cover No. 1**
late birth, 189
Roosevelt, presented to Zoo, **143**
- F**
- Farm-in-Zoo, attendance in 1955, 189
" 'Fifty-six Will Be a Great Year," 188
Food, animal, in winter, 170
of animals, 98
Frog, Giant, of Cameroons, **143**
Frogmouth, Tawny, new arrival, **15**
- G**
- Gayal, and calf, **180**
Gazelle, Arabian, **145**
Gecko, Tokay, **25-27**
Gifts, reptile, 66
Giraffe, Masai, new arrival, **16**
Gorbman, Dr. Aubrey, elected Fellow, 29
Gordon, Myron, "Lake Petén Mollies Again," 13
"Those Puzzling Little Toms," 50
Gorilla, Lowland, life in wild, 162, **164, 165**
"Makoko," **162**
Mountain, **48, 168, 169**
"Oka," **Cover No. 4, 112, 113**
Grant, DeForest, presents Roosevelt Elk, 143
Gyrinocheilus aymonieri, **78, 79**
- H**
- Hamilton, Jr., William J., "Nature Spreads a Varied Table," 98
"Where Do Animals Go in Winter-time?" 170

Hatchet Fish, Silver, new arrival, **17**
 Head-breather, Siamese, 77, **78, 79**
 Hedgehog, longevity, 189
 Heron, Nankeen Night, hatches
 egg, 159
 Hibernation, 170
 Holothurin, analysis of, 93
 Howler, Black, 104, **106-108**
 Mantled, **105**
 Red, 105
 Hummingbird, Violet-eared, **76**

I

Iguana, Spiny-tailed, gift, **69**

J

Jakowska, Dr. Sophie, elected
 Fellow, 29
 "Jimmy," Chimpanzee, record
 weight, 127
 Jungle Fowl, relations with
 Seladang, 8

K

King Snake, Tropical, 69
 Kingfisher, Amazon, **75**
 Knight, Capt. C. W. R., 93

L

Lampropeltis doliata polyzona, 69
 Langaha, given to Zoo, **142**
Lepidochelys kempi, 148
Leptodeira annulata, **68**
Leptophis ahaetulla occidentalis,
 68, **70**
 Lester, Henry M., appointed
 Photographic Consultant, 29
 "How We Photographed a
 Rattlesnake's Strike," 116
 Levine, Mildred, memorial tree, 93
 Litter posters, attract attention, 63
 Lizard, "Flying," **141**
 Fringed, **Cover No. 2, 44-46**
 Lorenz, Konrad Z., gold medal
 recipient in 1955, 1

M

Manville, Dr. Richard H., new
 Curator of Mammals, **158**
 Market, bird, in Asia, **185**
 "Marmoset," Goeldi's, feeding
 habits, 91
 new arrival, 29
 second specimen, 63
 Marshall, A. J., "The Bower-birds,"
 34
 Martini, Helen, feeding deer, **145**
 McCrane, Marion, talks at schools,
 128
 McClung, Robert M., note on
 Callimico, 29
 Miller, Richard S., & Katharine
 Scherman, "Creatures of Sea Ice
 and Tundra Barren," 56
 Mollie, Lake Petén, **13**
Mollienisia petenensis, **13**
 Monitor, Komodo, **111**
 warding off, **181**
 Monkey, Howler, 104
 Red Spider, **108**

Mouse, Field, exposed nest, **175**
 Jumping, **174**
 "Mr. Ramshaw," boards in Zoo, 93

N

New Haven train, to Zoo, **92**
 Night Snake, Spotted, gift, **68**
 Nightingale-thrush, Russet-capped,
 72, 73

O

Ogilvie, Charles S., "Malayan
 Seladang," 2
 Oliver, James A., "Banana Bonanza,"
 66
 "Big Bluff from Australia," 44
 "Gecko, the Chirping Reptile," 25
 Onager, new arrival, 189
 Opossum, Mouse, **142**
 Orang-utan, "Andy," **176-178**
 Osborn, Fairfield, editorial:
 "The Gold Medal," 1
 "Trustees for Animals," 33
 "The Magnetism of Animals," 65
 "Jubilee Days at the Zoological
 Park," 97
 "Animal Personalities," 129
 "Livingroom for Animals," 161
 Fellow of AAAS, 158
 Member, Institut des Parcs
 Nationaux du Congo Belge, 62
 receives honorary degree, 126
 Otter, Giant, new arrival, **49**

P

Palm Viper, Eyelash, 69, **71**
 Horned, 69, **71**
 Panda, Giant, **101**
 Parking, fee raised, 93
 Penguin, Emperor, **115**
 "Annie," father again, 189
 diving, **141**
 King, **115**
 egg cracked, **145**
Phoca hispida, **58, 59**
 Pig, wild, **8**
 relations with Seladang, 7
 Platypus, Duck-billed, age of, 94
 weights of, 189
 Potter, Bronson M., captures
 Onager, 189
 Potto, Congo, **115**
 baby, **49**
Prionodura newtoniana, 36
Ptilonorhynchus violaceus, 35
 Puff Adder, African, newborn, **63**

Q

Question House, questions asked at,
 126

R

Rail, Ruddy, **74**
 Rat Snake, Tiger, 68
 Rattlesnake, Western Diamondback,
 "Herman," **116, 120-121**
 Regent-bird, 37
 Reptile Club, formed, 158
 letter about, 126
 Reptile gifts, from banana piers, 66

Rhinoceros, African Black, **110**
 Rieman, Terry, book by, 31

S

Saki Monkey, Red-backed, **17**
Scenopoeetes dentirostris, 37
 Scherman, Katharine, & Richard S.
 Miller, "Creatures of Sea Ice
 and Tundra Barren," 56
 Scott, George, feeds birds, **127**
 Sea-Cucumber, Holothurin from, 160
 Sea Lion, Steller's, introduced in
 pool, 93
 Seal, Gray, new arrival, 29, **49**
 Ringed, **58, 59**
 Seladang, Malayan, 2, **3, 10, 11**
Sericulus chrysocephalus, 38
 Singapore, Dr. Beebe visits, 182
 Skutch, Alexander F., "How Birds
 Handle Their Population
 Problem," 72
 Snail-eating Snake, 70, **71**
 Southwick, Charles H., "The Black
 Howlers of Barro Colorado," 104
Spilotes pullatus, 68
 Spoonbill, Roseate, **101**
 Subway, car card on Farm, **159**
 cards about Zoo, **93**

T

Tee-Van, John, receives honorary
 degree, 126
 Tiger, "Rajpur," **Cover No. 6**
Tomeurus gracilis, **50, 51, 54**
 Tree Snake, Green, 68, **70**
 Turtle, Atlantic Green, **151**
 Hawksbill, **151**
 Leatherback, **151**
 Loggerhead, **151**
 Ridley, **147, 151**
 Pacific, laying, **152, 153**

U

United Nations, visits Zoo, 94

V

"Vamp Till Ready," book mentions
 Zoo, 31
Varanus komodoensis, **111, 181**
 Viper, South African Horned,
 16, 17
 Vulture, Ruppell's, longevity, 159

W

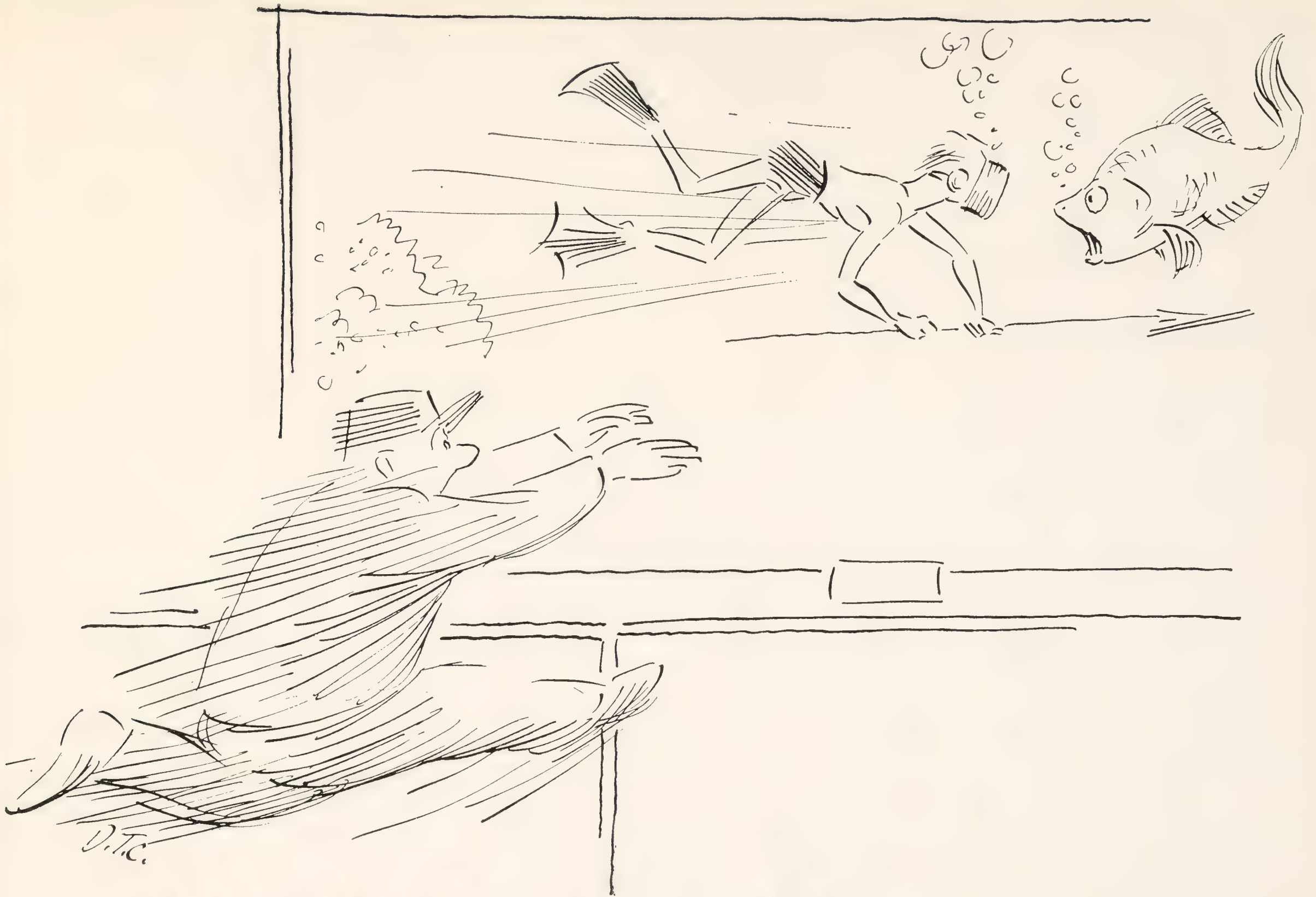
Walcott, Frederic C., gold medal
 recipient in 1946, 1
 Water Deer, Chinese, **144**
 Wren, European, **21**
 Shetland, **23**
 haunt of, **22**
 Winter, **21**

Y

Yerkes, Robert M., gold medal
 recipient in 1954, 1

Z

Zebra, hybrid, new arrival, **179**
 Zoo, praised in letter, 159
 Zoo Parties, increasing, 94
 Zoo Train, New Haven R.R., 63, **92**



Ready for Anything

We don't exactly expect any spear-fishermen in the new Aquarium. On the other hand, they wouldn't surprise us a mite. That's the joy of this business. Something different every day. Keeps us young and on our toes. Keeps our members young too. If you have any friends who are prematurely aging, give them memberships in the New York Zoological Society, or call their names and addresses to the attention of:

MEMBERSHIP COMMITTEE
New York Zoological Society
30 East 40th Street
New York 16, New York

SO YOU'RE GOING TO THE BRONX ZOO! HERE'S HOW—

AUTOMOBILE. *From east New York City and Long Island:* East River Drive N. across Triboro Bridge; Northeast on Bruckner Blvd. to Bronx River Parkway; North to Exit 5 for Bronxdale Parking Field of Zoo, or Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field.

From Long Island: Across Bronx-Whitestone Bridge, continue on Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), thence W. to Zoo.

From west New York City and New Jersey via tunnels: Henry Hudson Pkwy. N. to Dyckman St. and Broadway; N. on B'way to 207th St.; turn E. on 207th St., Fordham Rd. and Pelham Pkwy. to Zoo.

From New Jersey via George Washington Bridge: Through tunnel at east end of bridge, up ramp marked "Bronx-Bronx

Whitestone Bridge," E. to University Ave., N. on University to Fordham Rd., E. on Fordham to Zoo.

From Westchester and Connecticut: Merritt Pkwy. S. to Hutchinson River Pkwy. to Pelham Pkwy. (Exit 3-W), OR Bronx River Pkwy. S. to Exit 6-W for Pelham Pkwy. gate and Fountain Circle Parking Field, or Exit 5 for Bronxdale Parking Field.

From western Westchester and upstate: Sawmill River Pkwy. S. to Mosholu Pkwy., skirt Botanical Garden southward to Pelham Pkwy., turn left to Pelham Pkwy. gate and Fountain Circle Parking Field.

SUBWAY. *West Side (IRT):* Northbound East 180th St. Express to 177th St. Walk N. to Zoo.

East Side (IRT): Northbound 241st St.-White Plains Rd. Express OR East 180th St. Express to 177th St. Walk N. to Zoo.



ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY



VOLUME LIX
JANUARY TO DECEMBER, 1956
NUMBERS 1-6

Contents

No. 1. JANUARY-FEBRUARY

We Owe It to Wildlife	<i>Fairfield Osborn</i>	1
The Future of the Bighorn Sheep	<i>Helmut K. Buechner</i>	2
"Flying" Reptiles (Introduction by William Beebe)	<i>M. W. F. Tweedie</i>	11
Zoo Picture Pages	<i>Sam Dunton</i>	16
There Was a Story Behind Our First Inca Tern	<i>Lee S. Crandall</i>	20
The Markhor and the Saiga	<i>Richard H. Manville</i>	21
How Our New Onager Came to the Zoo	<i>Bronson M. Potter</i>	24
News from the Conservation Foundation		29
Behind the Scenes		30

No. 2. MARCH-APRIL

Spring — Here and There	<i>Fairfield Osborn</i>	33
My "Komodo Dragon" Circus	<i>Pat Collins</i>	34
Anteaters Become Milk-egg-meat-eaters in the Zoo	<i>William Bridges</i>	43
Zoo Picture Pages	<i>Sam Dunton</i>	47
The Bird's Nest as a Dormitory	<i>Alexander F. Skutch</i>	50
A Rare Gift: The Guatemalan Boa	<i>James A. Oliver</i>	56
In a Way, the Lungfish Is a Missing Link	<i>James W. Atz</i>	57
Saturday Morning Tours for Members		60
News from the Conservation Foundation		61
Behind the Scenes		62

No. 3. MAY-JUNE

"The Sea Around Us"	<i>Fairfield Osborn</i>	65
Nature's Skyscrapers	<i>George G. Goodwin</i>	66
Platyfish Come from Strange Places	<i>Myron Gordon</i>	74
Hortense Has No Tail to Tell	<i>James A. Oliver</i>	77
Springtime in the Zoo	<i>Sam Dunton</i>	80
Report on the Aquarium	<i>William Bridges</i>	84
The Dance of the Manakins	<i>D. W. Snow</i>	86
Behind the Scenes		91

No. 4. JULY–AUGUST

Time and Change	<i>Fairfield Osborn</i>	97
The American Beaver (Part 1)	<i>Albert R. Shadle</i>	98
The World's Only Venomous Lizards	<i>Charles M. Bogert</i>	105
This "Kinkajou" Was Really the Very Rare Olingo . . .	<i>Richard H. Manville</i>	109
Zoo News in Pictures	<i>Sam Dunton</i>	112
Ecologists Are Excited by England's "Rabbit Disease" . . .	<i>H. N. Southern</i>	116
Our First Pileated Woodpecker	<i>Lee S. Crandall</i>	123
News from the Conservation Foundation		124
Behind the Scenes		125

No. 5. SEPTEMBER–OCTOBER

No Limits to Science	<i>Fairfield Osborn</i>	129
In Malaya Looking for Clues to Crab Evolution	<i>Jocelyn Crane</i>	130
The Chamois	<i>Margaret Altmann</i>	137
Our Upside Down Catfish Grow Up	<i>James W. Atz</i>	141
Zoo News in Pictures	<i>Sam Dunton</i>	144
Lizards of the Sea	<i>James A. Oliver</i>	148
The American Beaver (Part 2)	<i>Albert R. Shadle</i>	152
News from the Conservation Foundation		157
Behind the Scenes		158

No. 6. NOVEMBER–DECEMBER

The Rightness of Animals	<i>Fairfield Osborn</i>	161
Muyoni, Our New Female Okapi	<i>Ralph Graham</i>	162
A Field Study of African Parks and Wildlife	<i>Fairfield Osborn</i>	170
We Are Moving into the Aquarium	<i>William Bridges</i>	173
Zoo News in Pictures	<i>Sam Dunton</i>	175
The Oddest-looking Crocodilian	<i>James A. Oliver</i>	178
The American Beaver (Part 3)	<i>Albert R. Shadle</i>	181
News from the Conservation Foundation		186
Behind the Scenes		187
Index to Volume LIX		190

ANIMAL KINGDOM



NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT Fairfield Osborn	VICE-PRESIDENTS Alfred Ely Laurance S. Rockefeller	SECRETARY Harold J. O'Connell	TREASURER David H. McAlpin
--------------------------------------	---	---	--------------------------------------

EXECUTIVE COMMITTEE

Laurance S. Rockefeller <i>Chairman</i>	<i>Class of 1956</i> Archibald S. Alexander A. Raymond Dochez Robert G. Goelet De Forest Grant Eugene Holman Warren Kinney William De Forest Manice Harold J. O'Connell Landon K. Thorne J. Watson Webb
George F. Baker, Jr. John Elliott Alfred Ely Robert G. Goelet De Forest Grant David H. McAlpin Robert Moses Harold J. O'Connell Fairfield Osborn Edwin S. Webster	

BOARD OF TRUSTEES

<i>Class of 1957</i> Robert E. Blum Percy Chubb, 2nd C. Suydam Cutting Alfred Ely Marshall Field Childs Frick Henry Clay Frick David H. McAlpin Richard C. Patterson, Jr. John H. Phipps	<i>Class of 1958</i> George F. Baker, Jr. F. Trubee Davison John Elliott Robert I. Gannon Peter Grimm Fairfield Osborn Eben Pyne Laurance S. Rockefeller John M. Schiff Henry Sears Edwin S. Webster, Jr.
--	--

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Richard H. Manville *Curator, Mammals*
Grace Davall . . . *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandal *Assistant Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch . . . *Assistant Curator, Education*
Quentin Melling Schubert *Superintendent, Construction and Maintenance*
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. . . . *Research Associate in Ichthyology*
Harry A. Charipper . . . *Research Associate in Histology*
Homer W. Smith . . . *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges . . . *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory
John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez
Alfred E. Emerson
W. A. Hagan
Caryl P. Haskins
K. S. Lashley
John S. Nicholas

AFFILIATES

C. R. Carpenter, *Co-ordinator*
Animal Behavior Research Programs
L. Floyd Clarke, *Curator*
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen
George E. Brewer, Jr.
John C. Gibbs
Samuel H. Ordway, Jr.
Hugh J. Ross
Robert G. Snider
Peter M. Stern

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

Suleiman Markhor	<i>Cover</i>
The Future of the Bighorn Sheep	
<i>Helmut K. Buechner</i>	2
"Flying" Reptiles	
<i>M. W. F. Tweedie</i>	11
Zoo Picture Pages	
<i>Sam Dunton</i>	16
There Was a Story Behind Our First Inca Tern	
<i>Lee S. Crandall</i>	20
Two New Animals: The Markhor and the Saiga	
<i>Richard H. Manville</i>	21
How Our New Onager Came to the Zoo	
<i>Bronson M. Potter</i>	24
News from the Conservation Foundation	29
Behind the Scenes	30

Vol. LIX FEBRUARY No. 1
1 9 5 6

We Owe It to Wildlife

THERE ARE INCREASING NUMBERS OF REPORTS that many species of the great mammals of Africa are having a hard time of it owing to encroachment on their reserves by rapidly increasing human populations and by the ever-wider use of firearms. The other day I received a letter from Dr. Victor Van Straelen, President of the Institute of the National Parks of the Belgian Congo, which reads in part: "My life is an endless battle for the maintenance of the national parks, always under the menace of the lumbermen, the meat-dealers and the prospective cattle-breeders. When the natives look at white people, covering thousands of miles in order to shoot at animals . . . we lose in a few days the benefit of years of preaching and teaching."

Our Society has a very vital interest in wildlife protection both in our own country and in other parts of the world. Why shouldn't we? In one sense we have no right to exhibit animals in our Zoological Park unless we at the same time do something to protect them in their native habitats. This year we will complete two studies on the situation of some of our own precious wildlife, namely, the Rocky Mountain sheep and some of the lesser fauna of the Western Plains. Now we are in the midst of formulating two projects which will provide us with first-hand information on the status of wildlife in certain regions of Africa.

Conservationists are winning some pretty good battles here at home right now. We have the feeling that our institution must do its share in helping to preserve wildlife in other parts of the world. After all, in the long years ahead our remarkable collections of animals from all over the world could not be maintained unless the animals exist in numbers in their own countries. Anyway, quite irrespective of this, wild animals also have a right to live.

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

FEB 23 1956

THE FUTURE OF THE BIGHORN SHEEP

By HELMUT K. BUECHNER

*Assistant Professor of Wildlife Management,
State College of Washington*



IN A LETTER of April 13, 1954, Dr. Fairfield Osborn inquired whether I would be interested in investigating Bighorn Sheep in the United States for the New York Zoological Society and the Conservation Foundation. From that day to this I have experienced one exuberant thrill after another in associating with this magnificent animal in its superbly scenic habitat. Our objective was to learn as much as possible about its current status, its population problems and its relationship to the vegetation of the area. With such a background, perhaps we could predict the future of the Bighorn Sheep and suggest means for assuring its survival as part of our native fauna.

The best plan, it seemed, would be to start with Colorado, the state with more Bighorn Sheep and more knowledge about them than any other. It was here that some phenomenal die-offs occurred in 1953, causing many people, particularly in the Denver and Colorado Springs areas, to wonder whether the Bighorn would be with us much longer. Not all of the sheep have disappeared, however, even in the three areas hit hardest by the disease. Much to my pleased surprise, I was able to take three kodachrome pictures of 16 rams — all in one group — at a distance of not more than a hundred feet, in the Pike's Peak area where fewer sheep succumbed than elsewhere. I spotted this bachelor band at about 300 yards in an alpine meadow that I had examined thoroughly for sheep the previous evening. After shooting ten pictures, I realized that these rams were not alarmed and not likely to take flight.

As a matter of fact, they all finally completed feeding and lay down to rest, so I took the opportunity to skirt the mountainside and crawl to within 150 feet. A sinking feeling came over me as I listened to the thunder of hoofs when the band picked up my scent. But these animals behaved in a fashion characteristic of surprised Bighorn Sheep and stopped to examine the intruder before running off. I could not have asked for better cooperation. That kind of behavior makes it a delight to photograph the Bighorn.

In Colorado I also visited the Tarryall and Kenosha Mountain ranges where probably fewer than 100 out of about 800 sheep remained after the epizootics in 1953. It was on the Tarryall in 1945 that Cleveland Grant made a remarkable series of pictures during the breeding season, some of which appeared in Disney's "Vanishing Prairie." The mountains were as quiet as a graveyard when I examined them, and Grant also experienced the same feeling of disappointment in the summer of 1954. Happily we know the sheep will build up again. Only eight individuals were counted after the great die-off in 1923-24.

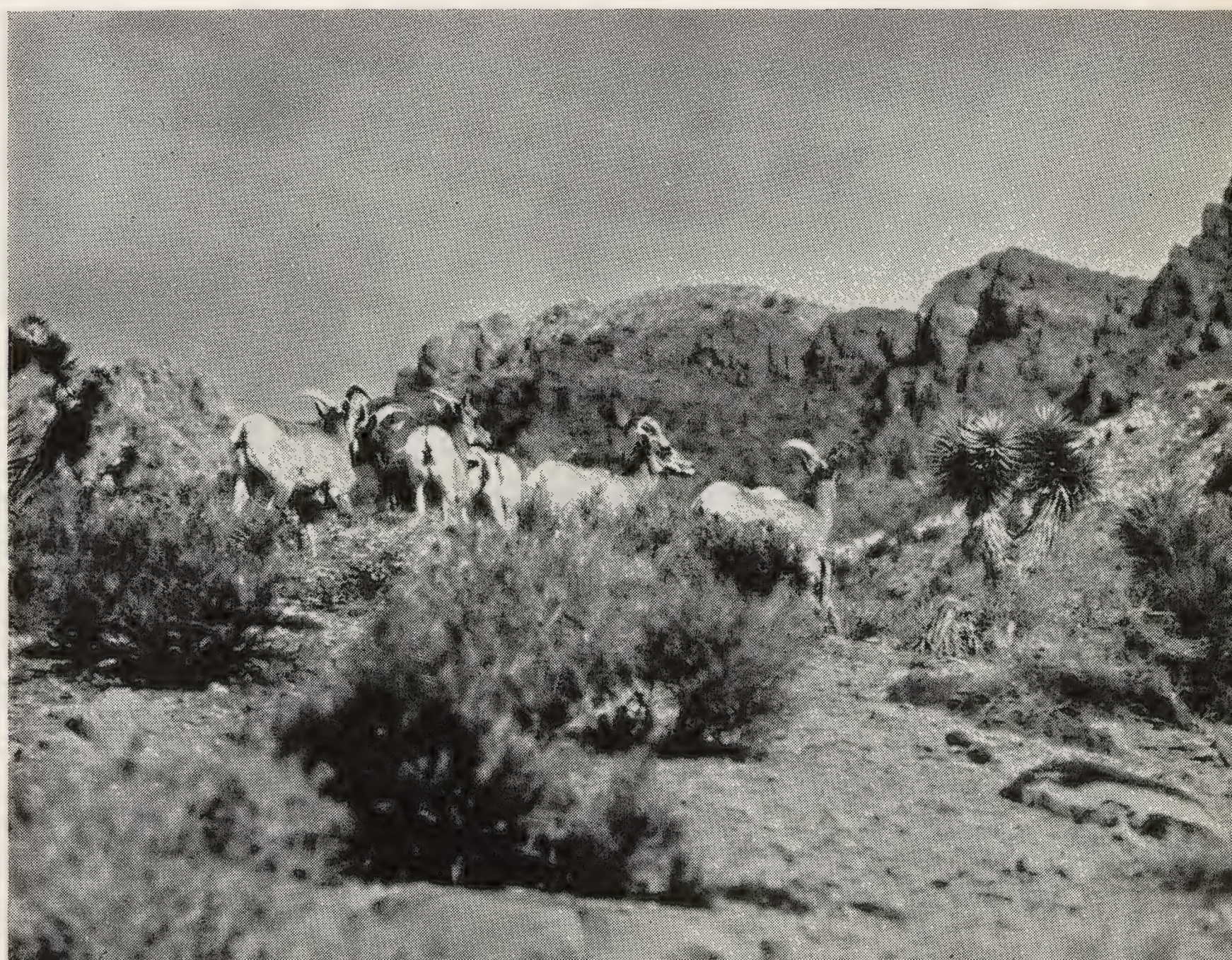
Wyoming was a startling contrast to Colorado in the practical matter of getting around in the sheep country. You can drive within walking distance of much of Colorado's Bighorn habitat — providing you have a little ambition for hiking — but in Wyoming it may take a full day of horseback riding to get to a place where you can see sheep. During the first three weeks in August, 1954, I saw only 38 sheep. Little did I dream that before completing the study I would see more of

A magnificent Bighorn ram peers over a shelf of rock in the Tarryall Mountains of Colorado. A Bighorn has a lot of curiosity — which often made the task of the photographer fairly simple.

Photo by Clifford C. Spencer

One of the largest Bighorn herds is on the Desert Game Range, an area that is now being considered for elimination from the Federal refuge system. Much remains to be learned about the Desert Bighorn, and this range is a great outdoor laboratory.

Photos by author unless otherwise credited.



Wyoming's Bighorns than anyone ever had the privilege of seeing before — not fewer than 1,300 out of an estimated maximum population of 2,000.

One of the natural focal points for the study was Yellowstone National Park where records have accumulated since the latter part of the nineteenth century. From February 7 through 9 I pored over records in the museum and prayed for a break in the weather so I could make an aerial count. On the night of February 9 the temperature dropped to 19° below zero and the skies began clearing. Pilot James D. Stradley called from Bozeman and said, "We'll never get a better day!" Having had temperatures of 25° to 32° and snowy weather for the preceding week, the sheep were particularly active, making conditions ideal for aerial counting. We saw 189 sheep (37 rams, 92 ewes, 33 lambs born in 1954 and 27 unclassified, of which 10 were ewes and lambs) from the plane and added three more from the ground the following day. Before starting we had been advised that we would be fortunate if we saw 150! Indeed, the numbers are lower than formerly on some of the favorite wintering areas such as Coal Mine Flat and the mouth of the Lamar River. Ernest Thompson Seton thought there were about 150 in Yellowstone when he lived there in 1897. The average of all estimates since 1903 is about 200. Today the Bighorn population may not be much lower than before the white man came. There can be no question, however, but that the herds have suffered in certain winter range localities from depletion of range forage by excessive numbers of Elk.

Twice during the aerial survey we found sheep watching us from caves. Two bigrams stood at the mouth of a cave while we flew by a second time to photograph them. On another occasion we searched for five minutes before locating two ewes far back in caves under ledges. Others could have been hiding in the shadows. Incidentally, this was the first aerial count of Bighorn in Yellowstone National Park and it proved the practicability and economy of securing data by this method.

Having experience of Stradley's exceptional ability in counting animals from the air, I engaged him to survey the Shoshone National Forest to the east of Yellowstone. Five contiguous

Wilderness Areas make this the largest block of organized wilderness in the United States. Our idea was to count sheep in the open alpine country during mid-summer. Big game is usually counted during severe winters when the animals are concentrated in relatively small areas. In making a summer count, we were pioneering — but it worked! In six days we saw 970 Bighorn, including 181 rams, 515 ewes, 256 lambs and 18 unclassified. Moreover, we saw some of the most breath-taking scenery on the continent, often from angles quite out of the ordinary. Occasionally we could see the Teton Mountains on the distant horizon to the southwest.

During horseback trips on Sheep Mountain about twenty miles northeast of Jackson, the Tetons were within easy view. Here Robert L. Safran and I saw 138 sheep in three days of observation. Of all the summer ranges in the country, I would choose this as the finest in every respect. Unfortunately, nearly all of these same sheep are forced to winter on ranges badly depleted by overpopulations of Elk. Only about a third of the 1934 population now exists in this locality — about 350 individuals — and the abused forage may prevent recovery to former abundance.

The best place for the general public to see Bighorn in Wyoming is on Mount Washburn in Yellowstone National Park. Here I became quite well acquainted with a band of 18, of which I could recognize nine individuals by peculiarities of horns and pelage. A matriarch with her right horn broken off short was definitely the leader of the band. I could scarcely approach without being detected first by this old ewe. Her lamb could be recognized by its rough coat. Were the genes of leadership being carried by this little fellow? One tiny lamb kept getting lost from its mother — or did the mother lose it? All day long I could hear the baaing of the ewe in the steep canyon. By dusk all 18 were together again for the evening meal.

During two weeks in Montana in the summer of 1954 I saw the important winter ranges and sampled the vegetation, but I saw no sheep. Returning on December 3 and 4 to participate in a ground count in the Sun River country about a hundred miles north of Helena, Faye M. Couey and I had the good fortune to see 121 out of the 262 that were counted. This is one of the finest

herds in the country. The breeding season was under way and we had an opportunity to observe the Bighorn's promiscuous behavior. Breeding was still going on at Christmas time when I spent a week there studying behavior, movements and food habits, with the assistance of Dwight R. Smith.

After the aerial count in Yellowstone National Park, I drove through blizzards to Jackson Hole where personnel of the U. S. Forest Service arranged for a "Sno-Cat" trip up the Gros Ventre River. Visibility was poor and we were unable to make an adequate count, although we did see 37 sheep. It was on this trip that for the first time I saw sheep coughing, a symptom perhaps of heavy infection with lungworm. Pitiful indeed was the sight of Bighorn grazing on the sparse forage of depleted ranges. These were part of the winter ranges to which most of the bands from the beautiful summer range on Sheep Mountain are forced to retire for the winter.

My plan was to examine the vegetation of ranges of Desert Bighorn Sheep during the spring growing season and to return to Wyoming and Idaho during the height of summer. Only about 500 Bighorn are found in New Mexico, with about half in the San Andres and Organ Mountains immediately west of White Sands and the other half in the extreme southwestern corner of the state. In September of last year only 58 were counted on the San Andres National Wildlife Refuge, which was set aside specifically for Bighorn Sheep. Seemingly, the Big Hatchet Mountains of southwestern New Mexico, where sheep are more concentrated, ought to be taken out of private hands for the protection of the Bighorn.

Most of Arizona's Desert Bighorn are in the southwestern part of the state. Near Yuma two large Federal refuges have been established for them. The Cabeza Prieta Game Range south of Yuma represents the most extreme desert in the United States and on much of it no livestock have been grazed, no deer are found and no Mountain Lions made their home even in the years before the white man's appearance. The vegetation is too sparse to support periodical burning, which might increase the yield of food. Nowhere else do Bighorn exist under conditions so nearly natural. Yet one aspect of the environment

is far from natural. The vast area is part of the U. S. Air Force proving grounds and periodically the desert is awakened by the thunder of rockets. Even personnel of the U. S. Fish and Wildlife Service are excluded from the Game Range during week-days, and consequently the opportunity to learn more about the welfare of these sheep is very limited.

The population is much greater on the Kofa Game Range north of Yuma, where 279 were counted at waterholes the last week in June of last year. The first morning I made the mistake of settling too close — about 150 feet — to the source of water. I was so busy taking notes and pictures of Mule Deer, Bighorn Sheep, Gambel Quail, Whitewing Doves and Mourning Doves that it was nearly 11 o'clock before activity quieted down and I was able to retreat. Temperatures were in the cool range of 105° to 110°. When it gets above 115° one begins to suffer — and to drink more than a gallon of water between breakfast and supper. I noticed that some sheep, especially ewes, approach water with the utmost caution. One ewe jumped back three times from a water tank as startled as if there were a rattler at the water's edge. Finally she drank. In contrast, mature rams are often amusingly incautious and approach with unwarranted boldness.

The largest game range in the United States consists of two and a quarter million acres. It was established in southern Nevada for the perpetuation of the Desert Bighorn Sheep. Nearly all the sheep in this state occur on the Desert Game Range, although reports of individuals or small bands have been coming into the Nevada Game and Fish Department from various other localities. Abolition of this Federal range is being threatened at present. Its size could be reduced without endangering the populations of Bighorn, but it seems too soon in our elementary stage of knowledge to abandon the entire range. We have no reasonable estimate of numbers on the range, to say nothing of a good understanding of relationships between population performance and drought. On April 29, 1955, I saw only three lambs among 70 Bighorn; the rest were 6 yearlings and 61 ewes. According to the pattern of the preceding ten years in that area, practically all of the lambs are born by May 1. However, my observations may not have been representative

and the production of lambs may have been far better than these data indicate. In the Pintwater part of the range, a waterhole count indicated 66 lambs per 100 mature ewes. Because rains made it unnecessary for sheep to come to waterholes, counts were not possible in the area where I had seen the 70 Bighorn. Much is yet to be learned about Desert Bighorn, and the Desert Game Range is an excellent outdoor laboratory.

California was full of pleasant surprises. Despite considerable effort and the help of naturalist Ralph E. Welles, I did not see Bighorn in Death Valley National Monument, but personnel of the Park Service and California Fish and Game Department observed 95 Desert Bighorn during a waterhole count last July, and estimated

Bighorn Crags in Idaho provide scenic habitat but one with relatively low carrying capacity.



Fine herds inhabit this summer range 20 miles from Jackson, Wyo. Beyond are the Tetons.



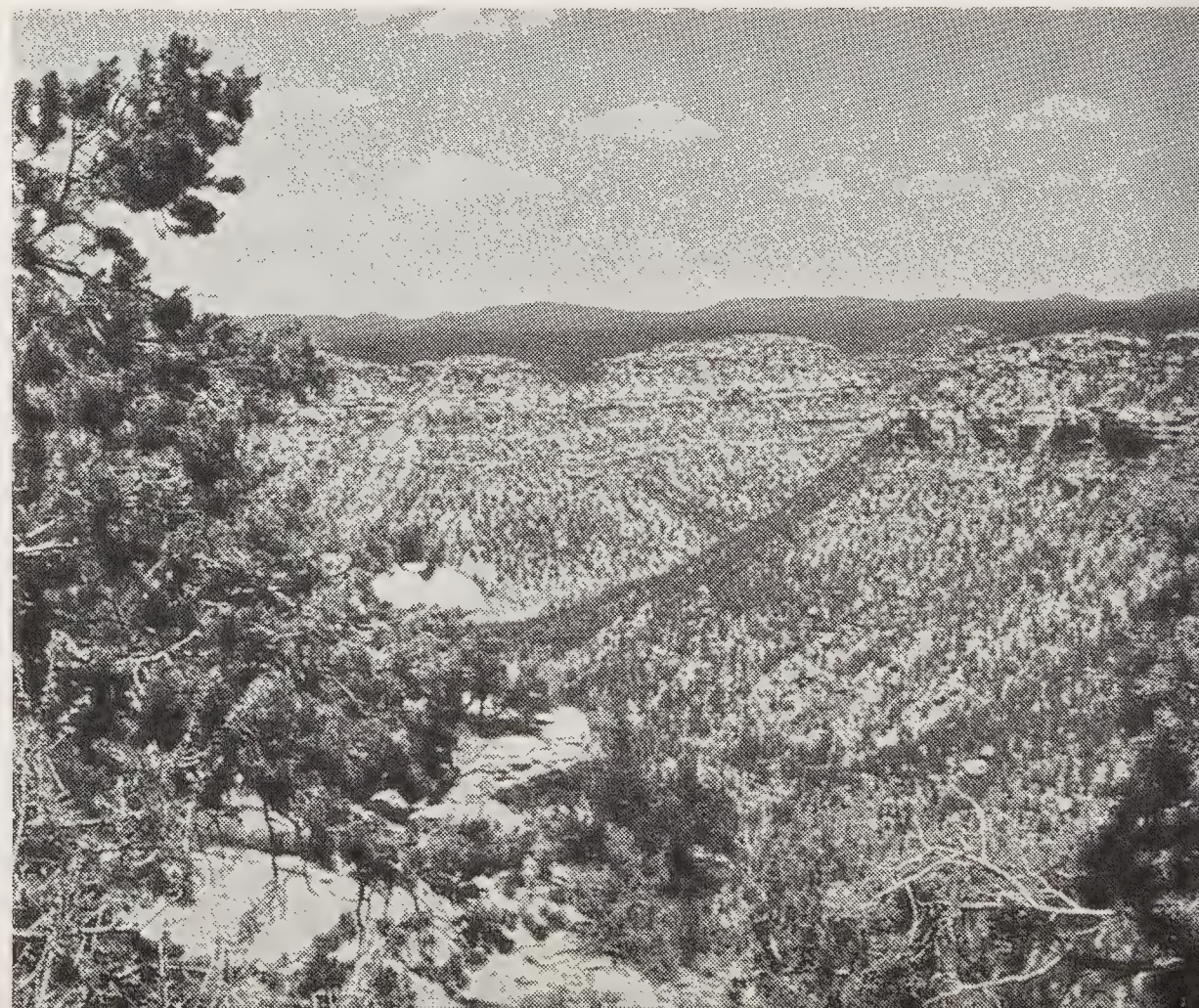
that about 260 now exist in the Monument. In 1939 the estimate based on waterhole counts and sign was about 150, of which 25 were seen.

Not all Bighorn are remote from large centers of human population. From the corner of Hollywood and Vine in downtown Los Angeles, it took only an hour and a half of driving through traffic and two hours of hiking to a point where I saw 25 Bighorn Sheep. In driving from Palm Springs along the palms-to-pine highway to Edyllwild, you may see sheep crossing the road. Fred L. Jones and I photographed two ewes and two lambs within less than a quarter-mile of this highway. It runs through the middle of the home ranges of some of these Bighorn, and they are not "crossing" from one range to another as the public imagines.

Most of the Bighorn of California exist in the deserts of the southern part of the state. Much needs to be learned about numbers and the dynamics of populations if we are to understand and perpetuate these animals.

The remaining state with a sizable Bighorn Sheep population is Idaho. In 1952 Dwight R. Smith estimated 920 sheep on 60 miles of winter range along the Middle Fork of the Salmon River. A large portion of this number was actually counted. On the same range only 400 sheep were estimated in 1934. This definite and material increase is very encouraging. Most of the Bighorn Sheep in Idaho are found along the main Salmon River and two of its principal tributaries, the Middle Fork and the South Fork. In other mountainous portions of the large Idaho Primitive Area from Hailey north to Elk City are scattered populations of low density.

Herds were re-established in these canyons in the unique Mesa Verde National Park in 1947.



Ovis canadensis canadensis

State	estimated population	
	min.	max.
Colorado	2500	3200
Idaho	2400	2800
Wyoming	1800	2000
Montana	1400	1700
South Dakota		22
Utah	Remnant	
Total	8100 - 9700	

Ovis canadensis mexicana

State	estimated population	
	min.	max.
Arizona	3000	3500
New Mexico	400	500
Texas	Remnant	
Total	3400 - 4000	

GRAND TOTAL
15,000 - 18,200

Ovis canadensis californiana

State	estimated population	
	min.	max.
California	200	400
Oregon		24*
Washington	Remnant	
Total	200 - 400	

Ovis canadensis nelsoni

State	estimated population	
	min.	max.
Nevada	1500	2000
California	1800	2100**
Total	3300 - 4100	

* Result of transplant from British Columbia to Hart Mountain National Wildlife Refuge in 1954.

** Includes intergrades between *O. c. nelsoni* and *O. c. mexicana* and *O. c. cremnobates*. Probably some populations of distinct *O. c. cremnobates* exist in extreme southern California but since the taxonomic status is uncertain and little is known of numbers, these animals are included here under *O. c. nelsoni*.



IN SUMMARIZING impressions of the Bighorn situation as a whole, I was impressed first by two seemingly incongruous facts. On the one hand, overpopulations result in repeated die-offs from disease or other causes, and on the other, Bighorn Sheep in the United States have dwindled from perhaps 1,500,000 (maybe 2,000,000) to somewhere between 15,000 and 18,000 head.

How is it possible for overpopulations to arise and what causes die-offs? Populations of Bighorn Sheep increase more rapidly than one might expect when given the following conditions: (1) complete protection from either-sex hunting; (2) little, if any, competition from livestock and other big game; (3) increased forage production resulting from fire; and (4) a habitat capable of supporting high population density.

From the extremely small band remaining on the Tarryall range after the 1923-24 epizootic, the Bighorn population grew to not fewer than 400 by 1940. By 1952 the population was about 800 on the contiguous Tarryall and Kenosha ranges. Then, within a month, starting in late January, 1953, the bands began dying one by one on the Tarryall winter range where 400 sheep were

Five rams in the Rocky Mountain National Park in Colorado photographed in 1936. There has been a heavy die-off in this region.

Both photos by M. K. Potts

Before the die-off occurred in Rocky Mountain National Park it was easy to get such pictures: a mature ewe and 2-year-old ram.

crowded into an area approximately 3 by 23 miles. Three hundred and seventy-six carcasses were found, and the following winter only 27 Bighorn were seen on this same range.

The immediate cause of death was determined, on the basis of three complete autopsies and several other examinations, to be pneumonia. Tracing the cause back a little further, it was established that the lungs were conditioned to susceptibility to pneumonia by the presence of thousands of larvae and the adults of the lung-worm, *Protostrongylus stilesi*, a parasite which occurred in Bighorn Sheep long before domestic sheep were introduced in North America. We know that this parasite is usually present in herds

of native sheep, but that the intensity of infection seems to build up as the density of the population increases. Larvae are coughed up, swallowed, and passed out of the body in the droppings. Certain kinds of snails serve as intermediate hosts for the larvae until they complete three molts to fourth-stage infective larvae capable of reinfecting Bighorn Sheep when the snails are eaten along with food. Obviously, the larger the number of infected droppings on the range the greater the number of infected snails. Consequently, when sheep are present in large numbers, they are more likely to be infected with lungworm.

Die-offs known to have been caused by the lungworm-pneumonia complex have taken place in Glacier National Park, Yellowstone National Park, the Sun River country and the Pike's Peak area of Colorado, as well as the Tarryall and

Kenosha ranges. Presumably this particular disease mechanism operates as one of the common natural controls in reducing high densities of Rocky Mountain Bighorn Sheep. Probably this mechanism has been in operation for thousands of years.

Unquestionably the best protection for Bighorn Sheep against epizootics is to keep the numbers from becoming too high in local areas that lend themselves to supporting high densities. The only way to accomplish this objective is through hunting. Shooting Bighorn seems an odd way of *protecting* the species, but to the thinking conservationist "wise use" is a part of the modern philosophy of conservation. All the states with more than a remnant of Bighorn Sheep, with the exception of California, have had open seasons on rams in recent years. In a promiscuous species like the Bighorn, the effect of harvesting



only rams is to encourage population increase rather than to stabilize or reduce numbers. Reducing rams provides more space and forage for ewes — the very individuals that keep adding to the population — and it is their welfare that is primary in determining the rate of increase. Only by knowing the actual population through counts and reasonable estimates, and by harvesting both ewes and rams under carefully controlled permit seasons, can the numbers be controlled by hunting. The only attempt throughout the nation to harvest either sex was made in 1954 in the Buffalo Peaks area of Colorado, where a herd of about 200 animals is currently threatened with the lungworm-pneumonia complex. But in 1955 the recommended either-sex hunt received a political veto. Will this band go down as the Tarryall, Kenosha and Pike's Peak herds did in 1953?

THE PRESENT STATUS of Bighorn Sheep in the United States is shown in the graph on page 7. The Audubon race — if this was a valid subspecies—is completely gone, having formerly occupied extreme western Nebraska and the badlands adjoining the Missouri River in North and South Dakota. Of the five races still living in the United States, *Ovis canadensis californiana* is represented by the smallest number, with somewhere between 200 and 400 head living in the beautiful high Sierra Nevada and a few in Washington and Oregon. Perhaps about 1,000 live in British Columbia, and this is the extent of the race. The race known as *O. c. mexicana* seems to be holding its own in Arizona, but the population in New Mexico is not over 500 and only a remnant remains in Texas. The status of the Nelson Desert Bighorn in Nevada is virtually unknown, but presumably the sheep is still present in good numbers on the Desert Game Range. Sheep of the deserts of southern California are probably mostly *O. c. nelsoni*, but this race intergrades with *O. c. mexicana* in the Colorado deserts and also with *O. c. cremnobates* in extreme southern California. Safest in numbers and probable future are the Rocky Mountain Bighorn Sheep, with approximately 8,000 to 10,000 individuals.

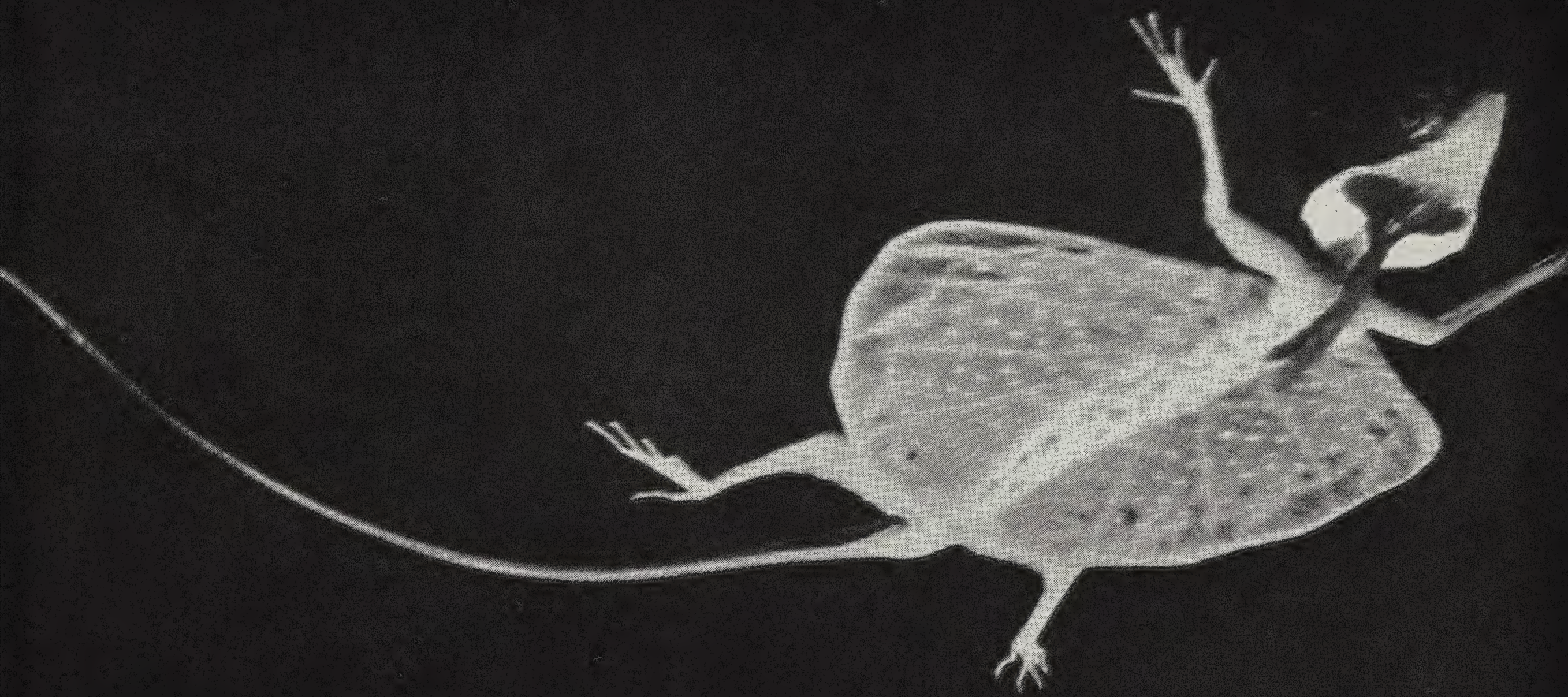
What is being done by state and federal agencies to help the Bighorn situation? Excellent

progress has been made in reestablishing the sheep on ranges from which they have been extirpated. The introduction of 20 California Bighorn from British Columbia to the Hart Mountain National Wildlife Refuge in eastern Oregon was the latest attempt of this sort. Successful introductions have been made on the Fort Peck Game Range in Montana, on the Sandia Mountains overlooking Albuquerque, New Mexico, and in many localities in Colorado, including Mesa Verde National Park.

Knowledge of the trends in individual herds is essential to proper protection and management. Some ranges lend themselves better than others to the determination of numbers. In general, populations of Rocky Mountain Bighorn are better known than those of the Desert Bighorn Sheep. Numbers of the latter are today mostly estimates. Unfortunately, funds for counting populations of species as much reduced as are the Desert Bighorn are not easily forthcoming. Mass production of deer and other big game for multitudes of hunters seems easier to justify than providing quality hunting to only a few, or financing research on animals with a questionable future.

Research projects have been supported in recent years by departments of game in every state with more than remnant populations of Bighorn Sheep, but most of these were short-term projects and much fundamental research remains to be done.

Predicting the future is risky business. Nevertheless, it seems likely that Bighorn Sheep will continue as a part of our native fauna at least for the next century and probably much longer, depending on a number of events. Much can be accomplished through appropriate management, including reduction of competition from excessive populations of Elk, horses, domestic sheep and deer, or various combinations of these animals; keeping Bighorn Sheep populations below densities at which epizootics are likely to develop; eliminating poaching particularly where herds are small; transplanting to former native habitat from which Bighorn were extirpated; and maintaining large wilderness areas and Federal game ranges now in existence. Much of the future for the Bighorn will depend on the interest of people over the entire nation in supporting sound management and ever-continuing research.



Draco, the gliding lizard, is in full "flight." Its extensible ribs, joined by a flap of skin, may readily be seen as it sails downward and outward. The long tail is used for balancing.

By LIFE Photographer Peter Stackpole. © Time, Inc.

"Flying" REPTILES

By M. W. F. TWEEDIE

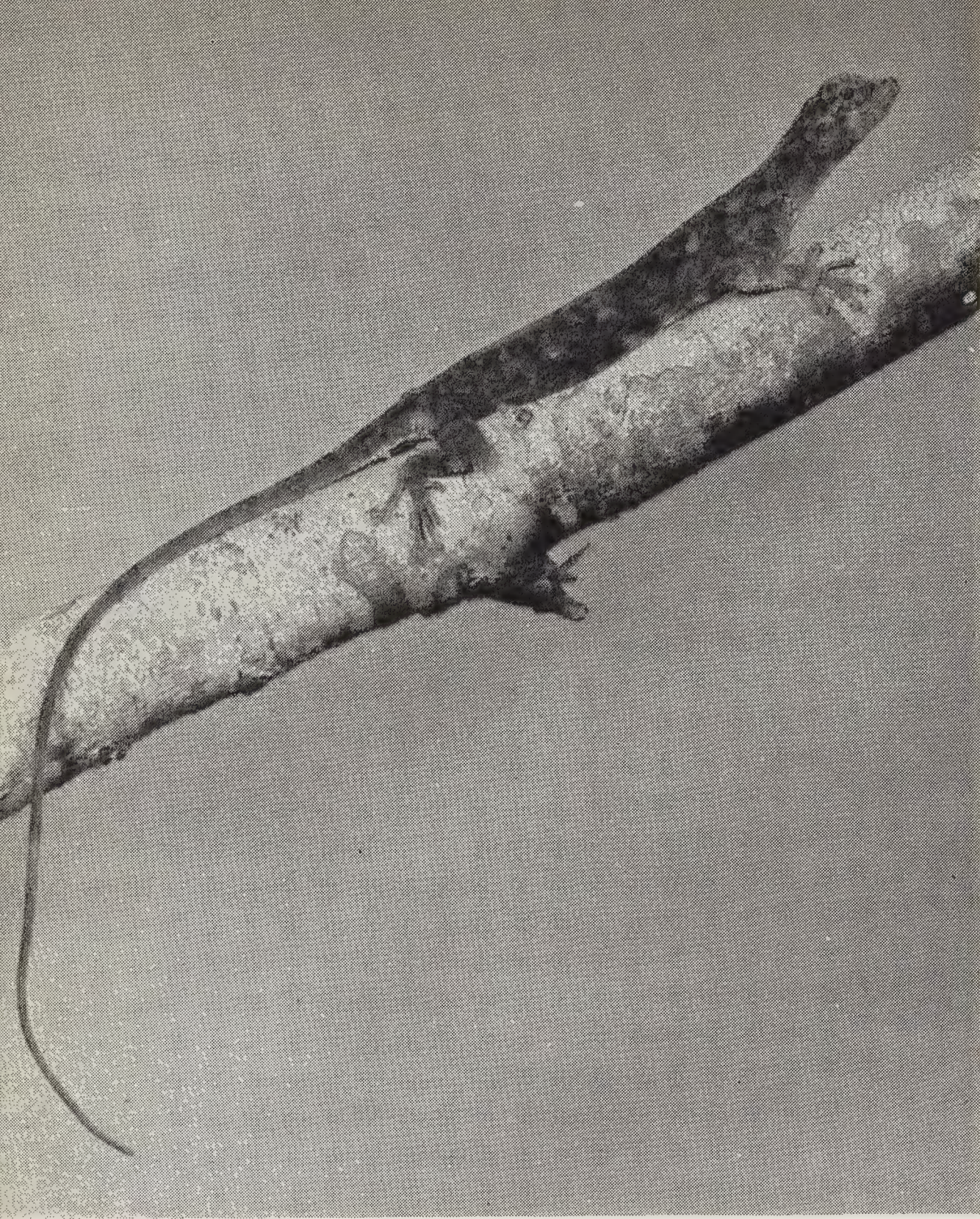
Director, Raffles Museum, Singapore

Introduction by
WILLIAM BEEBE

ON AUGUST SECOND while I was shaving in my bungalow in the Goodwood Park in Singapore, a lizard glided through the open window of the bathroom and landed with a plop close beside me. This was the first leg of the flying lizard's trip of twelve thousand miles, half around the world, on the wings of a Pan American plane instead of its own; a flight which ended in the reptile house of our own Bronx Zoo. Here it found a warm welcome, for it appears to be the first of the species in our collection.

So tightly were its skinny "wings" furled that even when I picked it up I had no idea of its identity. It was in process of shedding and draped with streamers of dangling skin. Not until I had unravelled the small reptile and seemed to be pulling its entire body apart did I realize I was holding the peeled off skin replica of one of the spread "wings." Through the cellophane transparency of the epidermis was visible the brilliant red spots and the bands of the actual flap.

Several days later I idly watched the shadow of a leaf, flicking back and forth on a palm trunk in



Draco at rest. When not gliding, it folds the flaps of skin alongside the body, out of the way as it walks or runs. Total length, 11 in.

Photos by author unless otherwise credited.

the Botanical Gardens. My glasses resolved this into another lizard with its crimson and yellow throat pouch, jerking back and forth. It soon seemed to fall asleep with eyes closed until a fly buzzed near, when the *Draco* crept slowly along, futilely stalking the insect. Next a wasp hovered overhead, one of the wicked, steel-blue giants, and the lizard rose on all four feet, half spread its flaps and lashed about with its tail. There seemed a distinct element of uneasiness, if not actual fear. Finally the creature crawled slowly upward and disappeared into the vegetation at the base of the lowermost frond.

One of the last of my lizard-watchings proved the most dramatic. Again a *Draco* flickered its parti-colored wattle in the Singapore Botanical Gardens, but this time on a very slender, sloping palm, overhanging the bushes at the edge of the forest. I saw all that happened from a grandstand seat near the orchid house.

A half-grown macaque monkey from a band nearby saw the lizard as soon as I did, and began to hitch up the sloping trunk. *Draco* watched the approach, and just before the little fingers could close over its body, it spread sail and leaped out into space in a graceful arc which ended ten feet up the next palm. It then looked up and

flickered in what we humans would call derision.

The inexperienced young macaque found the smooth bole difficult to descend, and a few feet down he slipped and fell. For some distance his feet and limbs worked frantically, and, catlike, he seemed actually slightly to orient himself. Before he landed unharmed on the fringing row of bushes he was fully spread-eagled. Had he fallen to the ground he most surely would have been killed or severely injured.

While I was in Singapore I asked Mr. M. W. F. Tweedie, Director of the Raffles Museum, to write a short account of the gliding reptiles as he has been acquainted with them for many years, and was instrumental in sending the shipment of living lizards to our Zoo. His article follows.

MOST NATURALISTS are familiar with the appearance of the "flying" squirrels and with their capacity for gliding from one tree to another, and so for traversing large areas of forested country without descending to the ground. Quite a number of mammals possess this limited power of flight, such as the flying squirrels and the so-called flying lemur. All of them are adapted for gliding in the same way, by the development of a web of skin between the fore and hind limbs which, when the limbs are fully stretched out, acts as a parachute to support the animal in the air. In the equatorial rain forests of Southeast Asia several kinds of arboreal reptiles are also endowed with this power of gliding, but the nature of the adaptations whereby they achieve it are curiously diverse and make an interesting study. During my association with the Raffles Museum I have had the opportunity of seeing most of the Malayan species of these gliding reptiles in life and some of them in actual flight.

Most highly modified, probably most efficient and surely the most attractive of all of them are the wonderful little lizards of the genus *Draco*, the "Flying Dragons" of the older textbooks. These have the hinder five, six or seven pairs

of ribs extending, in the form of cartilaginous rods, outside the body, and supporting a membrane of skin. The ribs are horizontally hinged at their bases and the whole apparatus can be folded up like a fan and laid along the sides, when it is scarcely visible and no encumbrance to the lizard when it is running or climbing.

As a rule the parachute is only spread when the lizard takes to the air, but occasionally it is half opened when two lizards are courting, chasing or sparring with each other. When it is closed and the animal stands motionless on a tree trunk the color of the body blends perfectly with the bark.

In flight these little reptiles are graceful and buoyant and glide at quite a small angle from the horizontal. The "wings" are brightly colored, those of the common *Draco volans* being blue

The Flying Gecko is considerably larger and more heavily built than Draco, and consequently less buoyant, gliding at an angle of about 45 degrees. This baby is six days old.



below in the male and orange with darker markings above. The first one I saw in flight I quite genuinely mistook for a butterfly and was most startled when it landed on a tree and was transformed to a drab, skinny little lizard.

All of them possess a scaly pouch on the throat with a smaller "wattle" on each side of it. Rods of cartilage (branches of the hyoid bone) project into these and the pouch can be flicked backwards and forwards. In most of the species it is brightly colored, yellow or red, and so is very conspicuous and its movement often betrays the presence of a lizard which one would not otherwise have noticed. Both sexes have the pouch, but it is larger and brighter in males. It is certainly used in courtship, but unaccompanied lizards can often be seen displaying it, and I think it also serves the purpose of a signaling device to

A sub-adult Flying Gecko, photographed on a sheet of glass, reveals flaps of skin coiled around the sides. These are spread outward by air pressure as the reptile begins its glide.

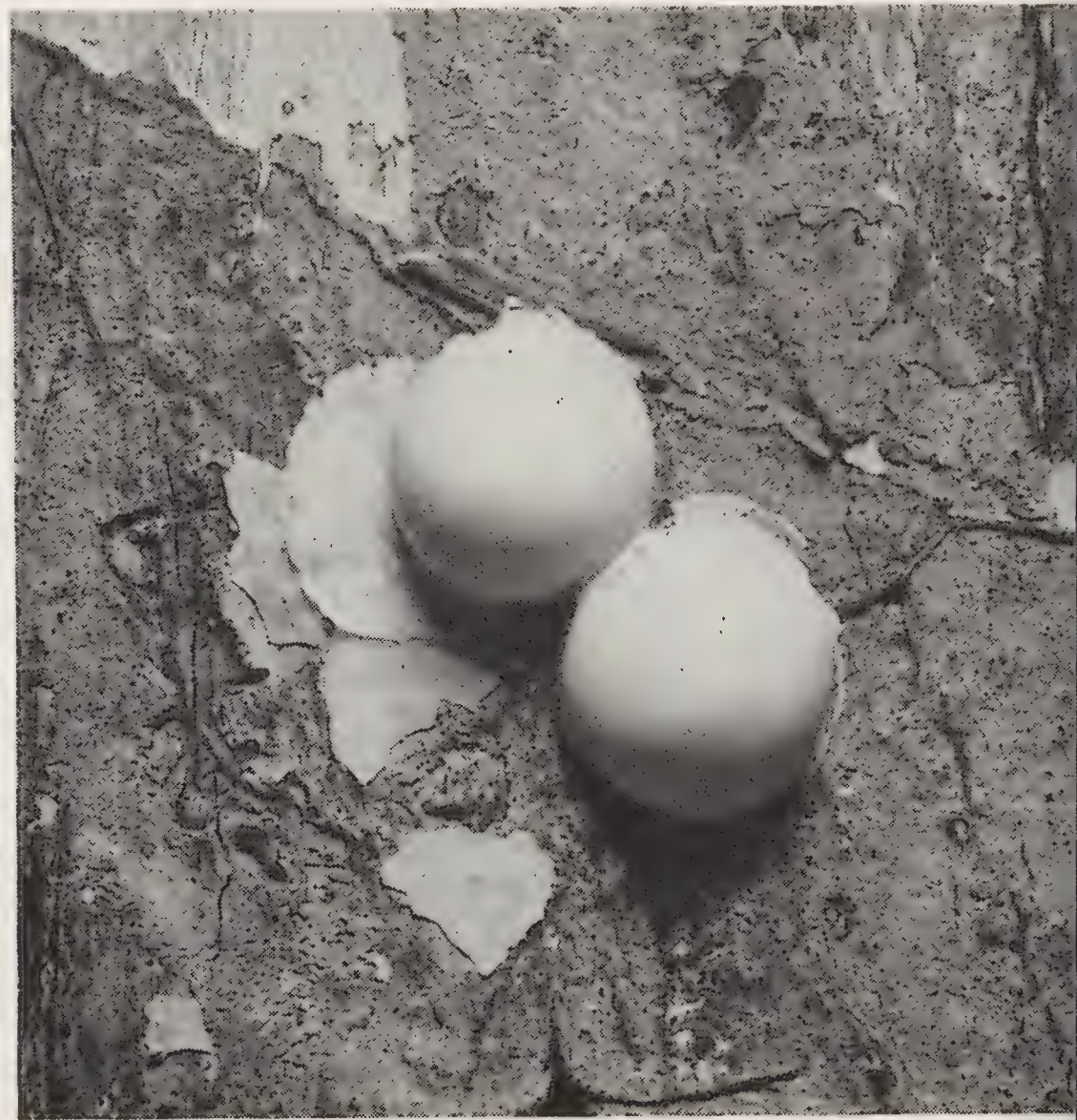
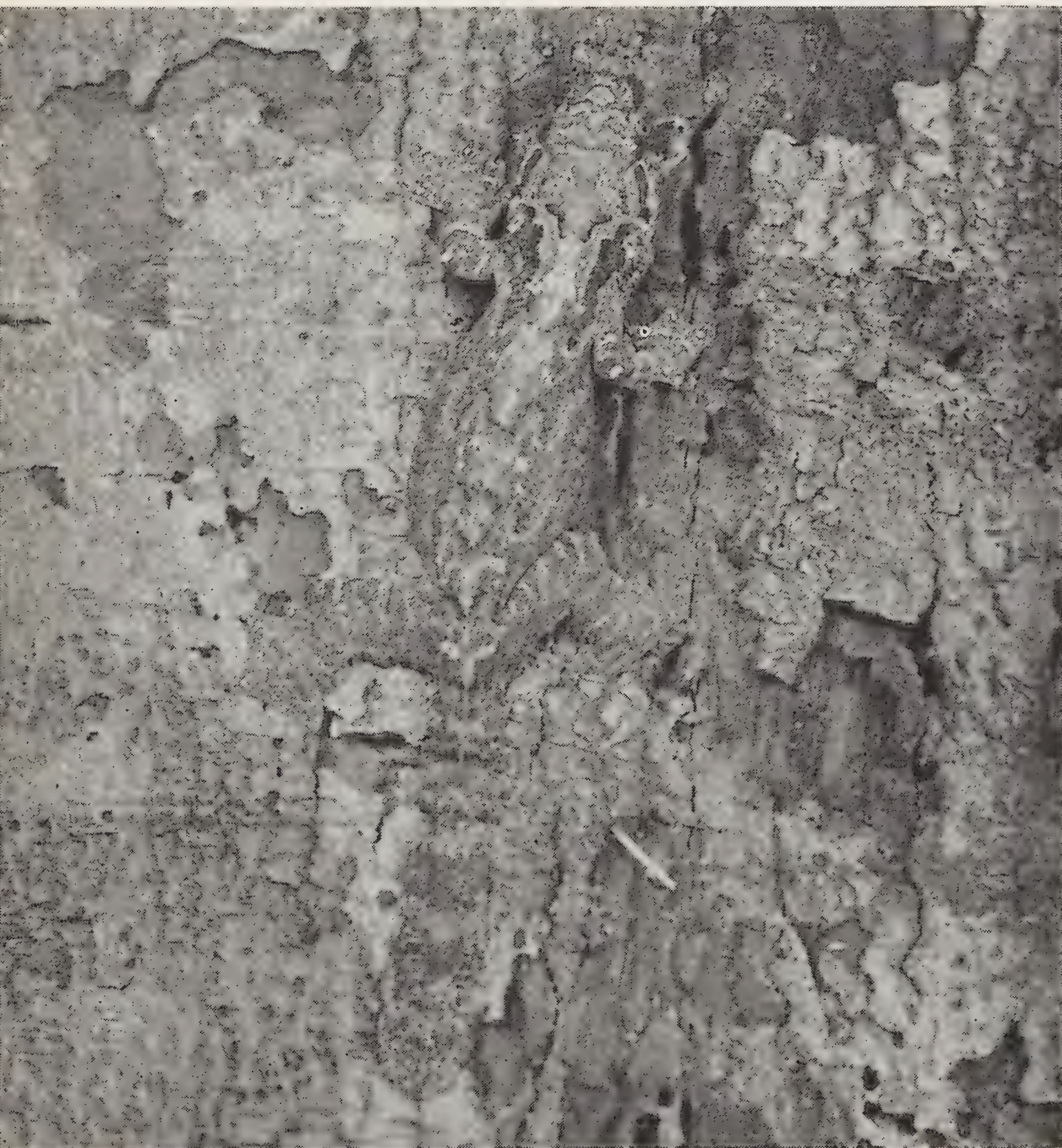


inform individuals of the presence of another member of their species.

The "flying dragons" belong to the family Agamidae. The only other lizards which are adapted in this way belong to the genus *Ptychozoon*, members of a totally different group, the geckos. Of the two Malayan species of gliding geckos Kuhl's Flying Gecko, *Ptychozoon kuhli*, is the more common. Its gliding mechanism, when compared with that of *Draco*, affords an interesting example of how the same object can be achieved in two quite different ways. On each flank of the gecko there is an outgrowth of rather thick skin, stiffened with fibrous tissue, strongly near the line of union with the body, distally progressively less so. It is not under any sort of muscular control and, when not in use, lies curled

side of the head is a smaller outgrowth of skin similarly disposed. The tail has a scalloped fringe of skin on each side, permanently extended, and the fingers and toes are broadly webbed.

When *Ptychozoon* takes to the air it starts with a sort of swallow dive. As it accelerates the pressure of the air on its underside forces open the two flaps of skin so that they project on each side. The degree and distribution of their stiffening is such that, under the falling lizard's weight, the air pressure and their own natural tendency to downward curvature are balanced when they lie in the horizontal plane of the body. These, together with the flaps on the head, the outstretched webbed feet and the frilled tail, enable the lizard to glide at an angle a little flatter than 45 degrees. It is a larger, more heavily built ani-



These two eggs of the Flying Gecko were deposited on bark, on top of the remains of previously-laid eggs.

Color and pattern make the Flying Gecko hard to see on bark. This one has regenerated the end of its tail.

round the body, the two flaps not quite meeting in the mid-ventral line. From below it looks a little as if the lizard were wearing a waistcoat, fitted in its younger and slimmer days and no longer susceptible of being buttoned up. On each

mal than *Draco*, and its total speed of air-resisting surface, although so diversely constituted, is considerably less, relative to its weight. It is, accordingly, much less buoyant in the air.

The eggs are most curious. They are always

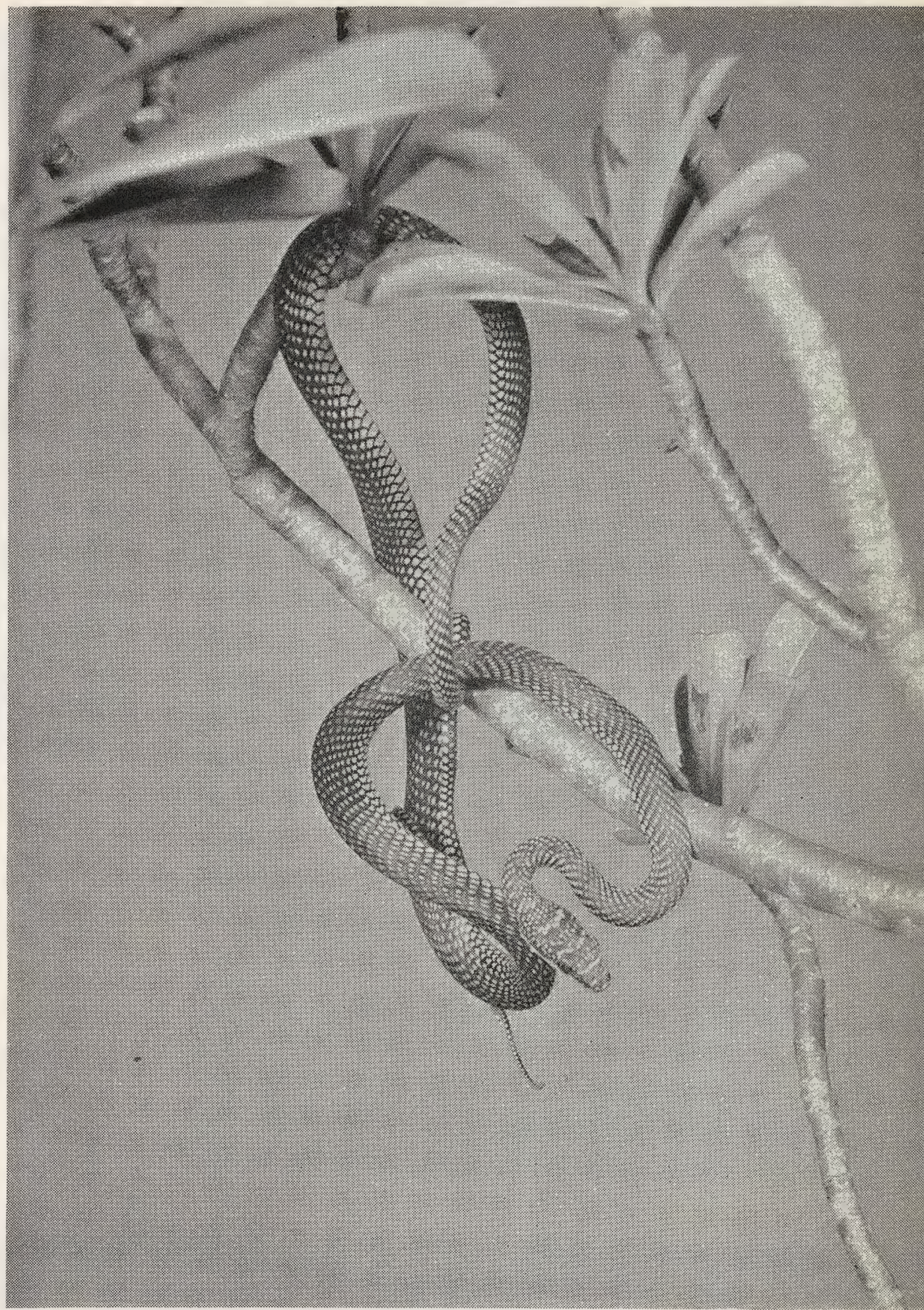
laid in pairs and have the form of hemispheres glued by their flat sides to the bark of a tree. Unlike *Draco*, therefore, which deposits its eggs in mould at the base of a tree, *Ptychozoon* need never come down to the ground. The pair of eggs illustrated, which was found on a tree under a mass of epiphytic orchids, shows an additional interesting feature. It can be clearly seen that one of them partly overlies a circle of shell representing another egg, which has hatched and of which only the adherent part remains. This circle overlies, in turn, yet another. I take this as an indication that the female returns repeatedly to the same place to lay her eggs. This suggests that she spends long periods, perhaps her whole life, in a restricted territory, possibly in some cases in a single large tree, for the interval between laying and hatching of the eggs is a long one, about ten weeks.

Both the young and adult gecko are colored and patterned for concealment against a background of bark, but in the young the tail ends in a conspicuous black and white "flag." When the lizard is stalking its prey this is twitched from side to side. The possibility exists that this is an adapta-

The so-called Flying Snake is a handsome reptile of green and black with a row of four-petalled red spots along the back. It is not as efficient a glider as many of the lizards.

tion to direct the attention of a predator to this "expendable" part of the gecko's anatomy at times when it is likely to betray its whereabouts by movement. The adult photographed on bark has at some time lost its tail, but has grown a new one.

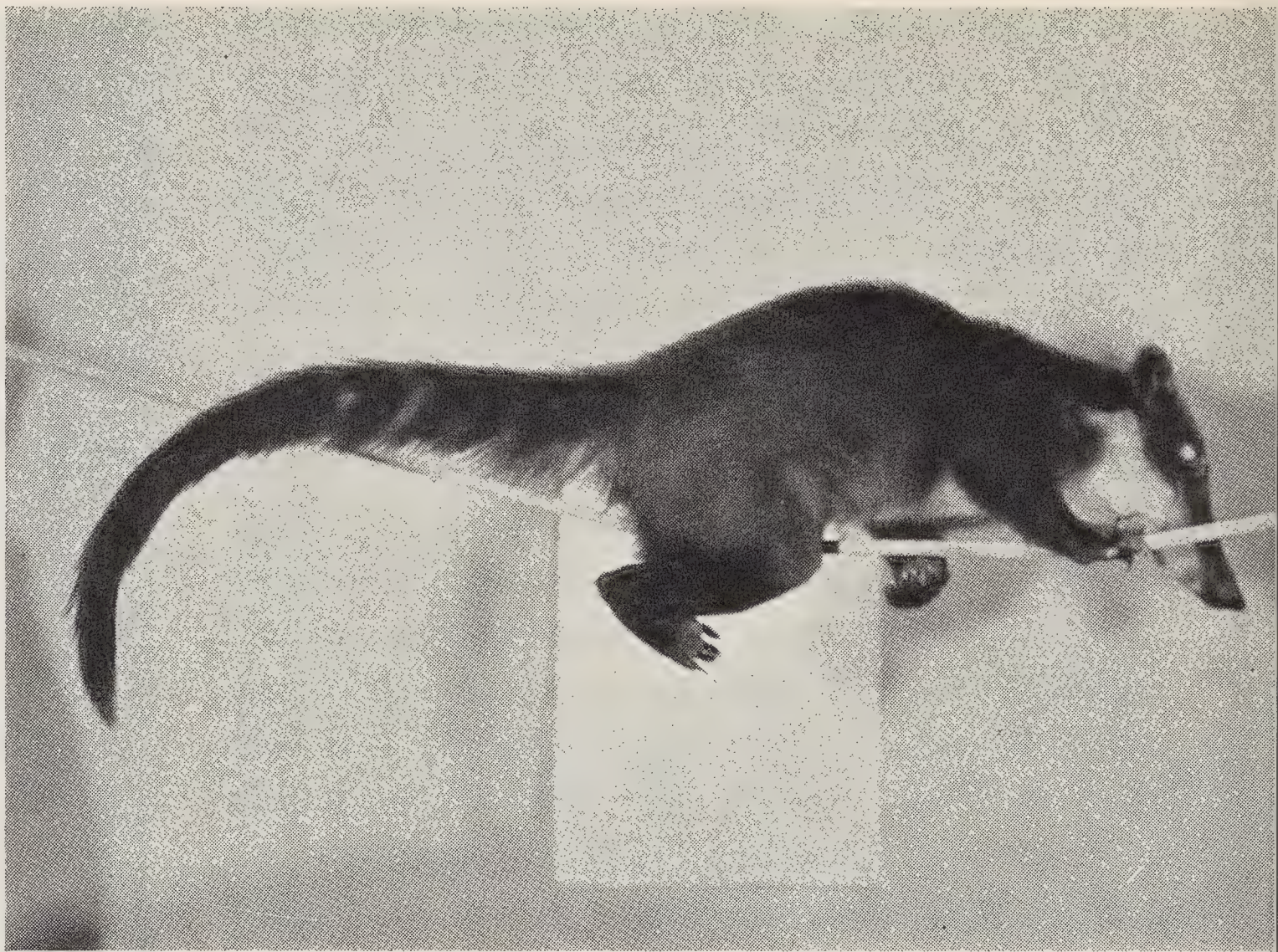
A number of species of arboreal colubrid snakes have a curious modification of the ventral scales — those scales, that is, which lie across the belly, each one overlapping the one behind it. Normally these are entire and (in the colubrids and most other snakes) span the under surface from side to side. The modification consists of a ridge on each side, a little short of the lateral end of the scale and traversing it at right angles, parallel, that is to say, with the axis of the snake's body. These ridges are, in fact, hinges at which the scales can be sharply flexed. Collectively they form two lines, one running along each side of



the belly surface, between which the belly can be drawn inwards, so that the body becomes hemicylindrical, like half a split bamboo.

One of the genera modified in this way is *Chrysopelea*, and on several occasions these beautiful snakes have been observed sailing through the air from the branches of a high tree. I have never been so fortunate as to witness this performance, but the English naturalist, R. Shelford, experimented with *Chrysopelea* in Sarawak and his observations make it clear that the snake achieves buoyancy by drawing in its belly and so trapping a cushion of air, just as a parachute traps air under the inverted bowl of its envelope.

Several other genera, *Ahaetulla*, *Dryophiops* and *Gonyophis*, have the ventral scales modified in the same way. All are arboreal snakes and I believe that they will all eventually be found to be gliders.



Zoo Pic

Photograph



Twelve years ago our Education Department began what has turned out to be an enormously popular service to schools in the New York area — sending a staff member to classrooms with a miscellaneous collection of small animals. In an average year our school traveller gives some 400 talks and shows the animals to 35,000 to 40,000 school children, and requests for her visits far exceed her capacity to travel from school to school in the course of a day. We know, by enthusiastic letters from teachers and children, that interest in animals and in the countries from which our travelling collection comes, rises sharply after a visit to the classroom. Miss **MARION McCRAKE** (left) is our current school traveller. One of her star performers is **TINKER**, a gentle Kinkajou from tropical America. Tinker generally sleeps in his travelling case on the way to school, and on being taken out he stretches, yawns, and gives such a graphic demonstration of complete relaxation that the children sometimes imitate him. **SNOOPY**, the Coati-mundi (also of tropical America), is another great favorite because of his extreme liveliness and activity. Recently, in periods between schools, Miss McCrane has been rehearsing Snoopy in a tightrope-walking act. He doesn't, actually, need much rehearsing, for he loves to climb and jump — witness the picture at the right, where Snoopy is making one of his flying leaps from a bookcase to the shoulder of the Education Department's secretary. Other animals in our school collection are a Skunk, a small Boa Constrictor, Great Horned Owl, two Sparrow Hawks, an Opossum and a Silky rooster.



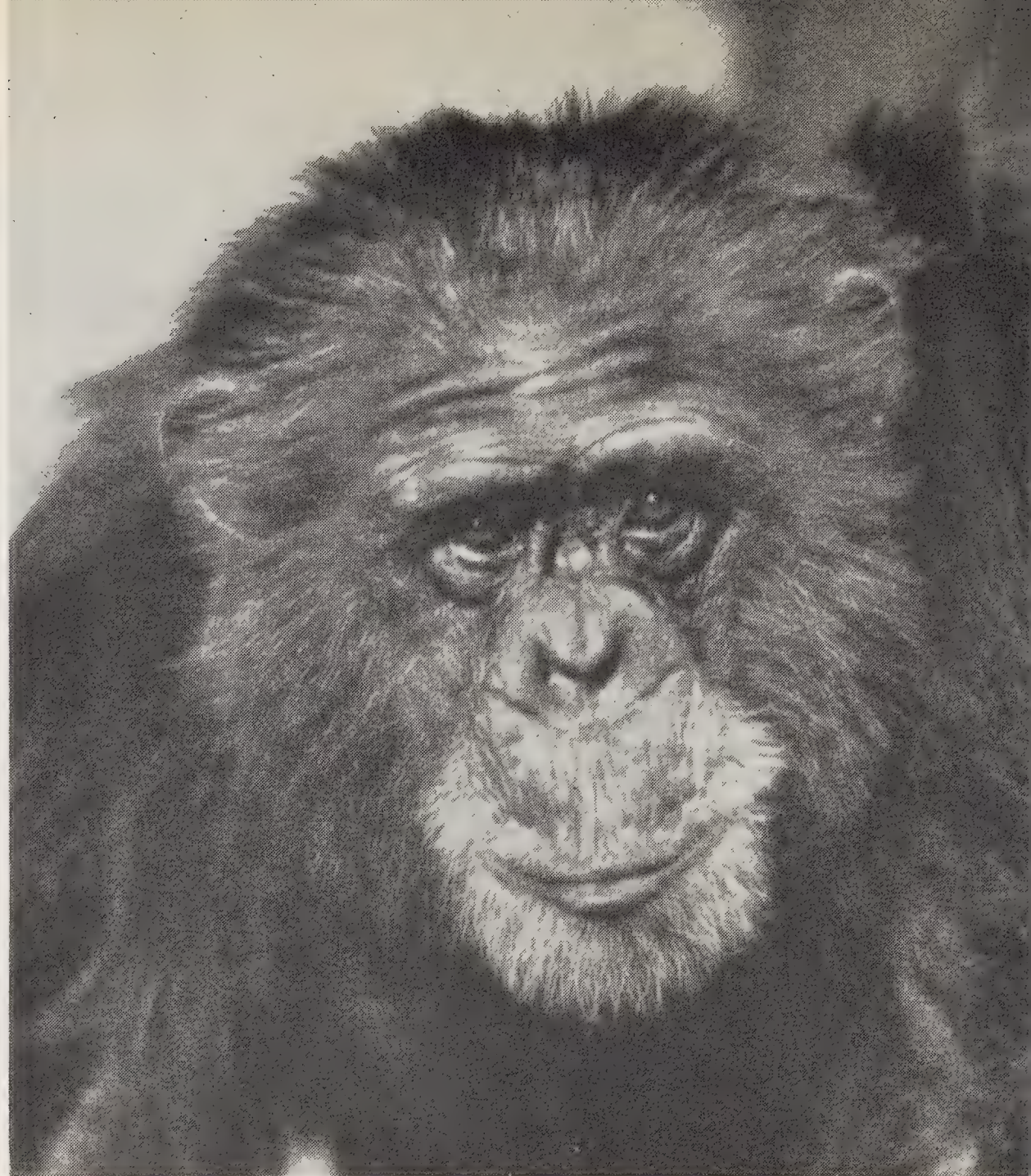
re Pages

M DUNTON





SCHWEINFURTH'S CHIMPANZEE
Pan troglodytes schweinfurthii (Giglioli)



BLACK-FACED CHIMPANZEE
Pan troglodytes troglodytes (Blumenbach)

Recently a European zoologist asked us for photographs of the various kinds of **CHIMPANZEES** we have exhibited, to aid her in identifying certain animals in European zoological gardens. It was a flattering request, for living Chimpanzees are notoriously hard to identify and some zoo men refuse to make the attempt; they simply refer to their specimens as "Chimpanzees" and let it go at that. The portraits on this page have been sent to the European zoologist. For the reasons why we call our Chimpanzees what we do, see the brief article on p. 30.

WHITE-FACED CHIMPANZEE
Pan troglodytes verus Schwarz



PIGMY CHIMPANZEE
Pan paniscus Schwarz



hundred million years ago there were plenty of **TUATARAS**, or their close relatives, in the Mesozoic world; today there are just a few Tuataras, on some small islands off the coast of New Zealand, and they are strictly protected. It is, therefore, a major event when the New Zealand government permits a specimen to be sent out to a zoological park. We have the good fortune to share with the London Zoo and the California Academy of Sciences in a shipment of three late January. Our new specimen is just a little more than 20 inches long (the reptile reaches a length of 30 inches) and weighs slightly over one pound. Only once before have we had a Tuatara, and Curator of Reptiles Oliver wrote an account of it in the January-February, 1953, issue of "Animal Kingdom." The present specimen came to us through the efforts of the Hon. M. P. Chapman, Vice-consul of New Zealand in New York. As the photo shows, it had good press coverage.



There is always a "last baby of the year" in the Zoo; it may be a Guanaco, or a Nyala, a monkey, or something else; in 1955 it was a **DINGO** — nine Dingos, in fact. This was the first litter from our pair of these Australian wild dogs, and the mother was obviously inexperienced in maternal duties, and even indifferent. She paid no attention to her offspring, which were born during the night, and as a result seven of the nine pups died within a few hours. By heroic measures Keeper Robert Wolanek managed to save two of them, which are spending the first few weeks of their lives in his home. At present they are as playful as domestic puppies.

There Was a Story Behind Our First Inca Tern

By LEE S. CRANDALL



Our new Inca Tern is by no means as trusting as a hand-reared bird, but it has no fear of its keepers and within a few days after arrival it flew down to take fish from their hands.

RECENTLY our Bird Department received from an importer in Florida an offer of an Inca Tern, just arrived from Chile. Since a search of the records showed that we had not had the species for more than twenty-five years, the purchase was promptly decided upon.

On the morning of January 10 our station wagon made the run to LaGuardia Field to pick up the air shipment from Florida, and later in the day there came word that the Inca Tern

could be seen in the quarantine quarters of the Large Bird House. With awakening interest, we took time off to renew old acquaintance. At first sight of lovely dove gray plumage, bright red bill and slender, down-curved white mustaches, memories came flooding back. They had to do with Charles L. Fagan, late wireless operator on the Grace Line's west coast South American run, a man with deep interest in birds and a Life Member of our Society. Strongest of all came recollection of a story he related of events that preceded the arrival of our first Inca Tern.

Early in April, 1924, Mr. Fagan, freed from duty while his ship was in port, was strolling in the outskirts of Valparaiso. He encountered a small boy and girl, one of them carrying solicitously an object wrapped in a white cloth, not too clean. From this dubious covering projected gray feathers, red bill and curling white whiskers. An Inca Tern! Familiar enough to seafarers along the southern west coast, this handsome bird had long defied Mr. Fagan's wish that its beauty might be seen in New York. His interest immediately aroused, he attempted to strike up a conversation but with no success — the children could not understand English and Fagan's Spanish was inadequate. Undiscouraged, he followed along until a small rain-water pool was reached. Here, the cloth was carefully removed and the tern set about a brief swim and a splashing bath. Its ablutions finished and its soft plumage wiped dry, the bird was wrapped again and the children started off, presumably for home. After them trudged Fagan, determined not to abandon his quest. At last the procession reached a small house in a somewhat squalid quarter and here the children, aware by now that something peculiar

was in the wind, produced their mother. Fagan brightened in her presence, hoping that at last he might make his purpose known. There was no difficulty about this, for the woman understood at once his gestures and mumbled Spanish. Nor was there any hesitation in her reply: a negative shake of the head and, surprisingly, two words in English, "children's pet." Further gestures and the production of what must have seemed a large sum of money, had no effect. The bird was not for sale.

Thoroughly depressed, Fagan made his way back to his quarters aboard ship. Next morning, the liner cast off for the long voyage northward. Graceful Inca Terns soared over the waters of the harbor, even perched upon the rigging of the ship. But the sight only served to add to Fagan's feeling of defeat.

That, however, was not the end of the story. The ship had hardly cleared the harbor, when there came a hurried knock on the door of the wireless room. In response to a shouted "Come in!" an excited oiler begged Mr. Fagan to come below and remove a bird that had somehow come down the ventilator and was flying back and forth in the propeller shaft tunnel. Fagan, well

known aboard ship for his interest in birds, was obviously equipped to relieve the oilers of this menace. Following his guide into the bowels of the ship, what should he see but an Inca Tern fluttering, on tiring wings, from one end to the other of the long and narrow space!

A few minutes later, an all but exhausted Inca rested quietly in a well-used box cage in the wireless room, gently taking bits of cut fish from the fingers of its rescuer. On arrival in New York, Mr. Fagan's first trip was to the Zoological Park, where he proudly presented us with his prize.

It was our first experience with an Inca Tern but the bird's gentleness and complete lack of fear, which we now know to be typical, was obvious. We placed it at once in the Flying Cage of the Large Bird House, where almost its first act was to hover over a keeper's extended hand and take a bit of fish from his fingers. Conspicuous for its beauty, admirable in its confiding ways, our Inca Tern completely justified its donor's hopes. A repetition of such a completely satisfying experience may be too much to expect but so far our new bird is following exactly the pattern set by its predecessor.

Two New Animals:

THE MARKHOR AND THE SAIGA

By

RICHARD H. MANVILLE

NEXT TO ACQUIRING AN ANIMAL we have never before exhibited, it is a joy to again show interesting species we have lacked for a number of years. We now have that pleasure in exhibiting two similar yet oddly divergent ungulates from the Old World — the Saiga and the Markhor. A pair of Saiga may be seen in the Antelope House, and the two Markhor have a new paddock atop Goat Hill.*

Neither animal is common in American collections and of late they have been extremely difficult to obtain from behind the Iron and Bamboo Curtains. We have had only two Saiga before, between 1936 and 1939, and the last of the four Markhor in the Park died in 1942 after ten years with us.

Recent workers place both these species in the same subfamily as the Chamois and Rocky

* Just before it was released from quarantine, as this issue was going to press, the male Markhor broke a leg. It may be some weeks before it, or a replacement, is on exhibition.



Leaping around the walls of its compartment in the U. S. Quarantine Station in New Jersey, where it has been kept for the past month, is a favorite diversion of our new young Markhor.

Mountain Goat. The Markhor is a true goat, closely related to such forms as the Ibex, Tahr, Burrhel, Aoudad, Mouflon and Bighorn Sheep; the Saiga is a distinctive type, most closely allied to the Chiru of the high Tibetan plateaus. In habits and general appearance, however, the two are quite different.

The Markhor, *Capra falconeri* Wagner, is regarded as one of the handsomest of the wild goats. It is heavy and massive, the body and legs covered with thick hair which is short and brown in the summer, gray and shaggy in the winter. Old males are adorned with a profuse, blackish beard and mane from the chin to the chest. Such specimens may measure more than 41 inches at the shoulder and weigh more than 200 pounds. But their most striking feature is the pair of magnificent, compressed, spirally-twisted horns, deep black in color and close-set at the base, which may measure as much as 5 feet in length along the curve. The form of these horns varies, almost

straight in some and twisted like a corkscrew in others, and on this basis have been described several geographic races which may intergrade in nature. Shorter horns, also compressed and spiral in form, are present in females. It is possible that the Markhor was the ancestor of the domestic goat of ancient Mesopotamia, surviving in the modern Circassian goat.

The name *Markhor* is in reference to its alleged snake-eating propensities, an attribute similar to that of the common goat in Scotland today. Over a wide range from Baluchistan, Afghanistan and Russian Turkestan through Kashmir to the western Himalayas, it occupies the zone between the forests and the perpetual snow, some of the most difficult of all this mountainous terrain to traverse. It surpasses all other goats in its climbing abilities, and is even said to ascend trees, climbing to considerable heights.

The Saiga, *Saiga tatarica* (Linnaeus), derives its name from the Russian *Saigàk*, or perhaps from the Caucasian *Sogak*. Its affinities are somewhat closer to the gazelles and Gerenuk than to the goats and sheep, although it occupies an intermediate position. It stands about 30 inches high at the withers, has a thick fleecy coat of dull

yellowish color in summer, turning nearly white in the winter. Only the males possess horns, which may be up to 14 inches long, are lyrate and ringed, and of a peculiar waxy or pale amber color. This curious creature is easily recognized by its enormous, truncated muzzle, the lip prolonged as a short proboscis, especially well-developed in adult males. The two nostrils are short and widely separated, with a depression between them, and owing to the inflated nose they are situated well back. The tubular nose can be shortened by wrinkling, and its peculiar structure — as though the animal had run head-on at full speed into a stone wall — has been suggested as a special modification to prevent sand particles from reaching the inner nasal chamber. This remarkable animal is further distinguished by a variety of cutaneous glands — beneath the eyes, between the toes, on each fore knee, and inguinal in position.

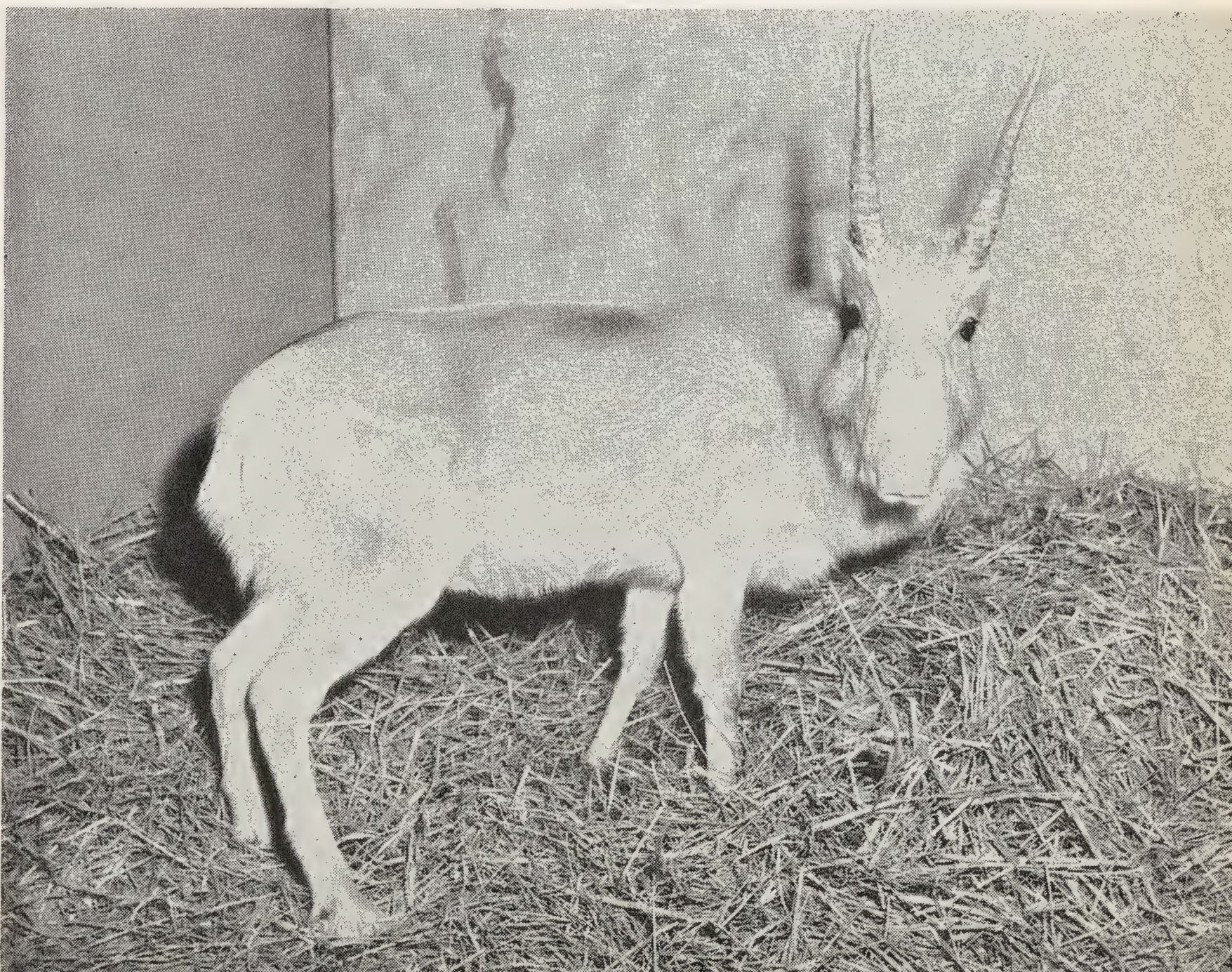
Today the Saiga dwells on the grassy steppes of eastern Russia and western Asia, confined chiefly to the Kirghiz steppes and the high plains of western Siberia. Fossil remains indicate that it once occurred in eastern China and westward to southern France, Belgium, and England. Gesner recorded it from Scythia and Sarmatia, and Buffon from Poland and Hungary. It was probably contemporary with Paleolithic man, for at least one recognizable sketch on bone has been preserved in cave deposits. But since this time, with the march of civilization, it has been compressed further and further, particularly as its

flesh, quite similar to mutton, is held in much esteem.

The Saiga, despite its numbers in the wild, is rare in captivity. In recent times the first ones were procured by Herr Constantin Glitsch, after nearly two years of searching, for the Zoological Gardens of Moscow in the early 1860's. On its native plains it is fleet and active, with keen senses of sight, smell and hearing, and very difficult to approach or capture alive. It is occasionally taken by natives, either by shooting or trapping; it has comparatively few other natural enemies.

Together with the gazelles, wild asses, Oryx and Addax, the Saiga is a typical ungulate of the semi-desert regions. It feeds largely on leafy shrubs similar to the sagebrush and grease-wood of our western plains. Its slight needs for water are satisfied largely by its food plants and the dew condensed on them. It is a highly social species, moving in herds that number from a dozen to a hundred individuals. It undertakes considerable seasonal migrations, in search of food or of more clement weather. Winters are spent in areas generally free of snow. Here mating occurs, and with the melting of the snows the herds move northward, the bucks first, followed by the does. The young are born in late spring on the higher steppes, and here the groups break up into smaller scattered bands throughout the summer. With the coming of snow and cold they again congregate into larger herds for the long southern trek.

A Saiga is a solemn and rather grotesque animal. This is one of the pairs of young animals we have just acquired, while still in the U. S. Quarantine Station.



How Our New Onager Came to the Zoo

By BRONSON M. POTTER

In November the Zoological Park received a young male Onager, or Persian Wild Ass, captured and delivered by Bronson Potter of New York — the first Onager we have had since 1937. This is Mr. Potter's account of how he captured the animal in Iran.

IN PERSIAN folklore and art the Onager, or Wild Ass, plays as traditional a role as the buffalo does in the United States. In painting, bas-relief, and poetry it has been recorded in centuries past as the symbol of kingly sport; when Persia was a vast nation encompassing most of the East, hunting the Wild Ass from horseback was a common royal pastime, a diversion from warfare. In folklore, particularly in folksong, the Wild Ass inhabits the vast deserted wastes, the huge tracts where there is only Allah and the solitary wanderer.

A watercolor of a hunting scene was my first introduction to the animal. I had motorcycled from Yugoslavia to visit a friend, Fereydoun Ala, in Teheran. Fereydoun's father, the Premier, suggested that we go to the Teheran museum to see the antiquities. In the museum there was a watercolor of a hunting scene. There was a horseman, mounted regally, pursuing an equine animal.

Persian art wonderfully stylizes the motion of animals. The hunter's horse was rearing with its front legs curved gracefully beneath it. The game was a strange tan and white animal, and it too was leaping delicately. The hunter's bow was bent, the arrow not yet sped. I found myself waiting to see the arrow fly.

Fereydoun told me that the animal was a Wild Ass, *Equus onager*. We looked at the print for a few minutes and then moved on through the museum. It was not until a month later, a thousand miles away, that I thought of the dusty print, for when I left the Teheran museum it was forgotten immediately in a thousand other sights

and impressions of Iran. A month later in Southern Iran we were amazed to see tracks that could have been made only by large groups of equine animals. It was then that we first hoped to photograph the Wild Ass, and I remembered the watercolor in Teheran.

Fereydoun and I left for Shiraz shortly after the visit to the museum. We hoped to get to Neyriz and look for gazelle. Also there was a group of mountains about sixty kilometers west of Neyriz that, as far as Fereydoun and his hunting friends knew, had never been checked for game. In Shiraz we stayed at the house of Narcy Firouz, a Yale graduate and an ardent hunter. When he heard that we were interested in doing a little exploring, he offered us his jeep and his company. Of course we were delighted. Narcy was an expert hunter, and with two jeeps we could pick up a crew of villagers to make life easy.

Accordingly, we checked over our gear and prepared to start in three days. Our main cargo was gasoline and pure water. Neither would be available when we passed Neyriz. We also carried our hunting and photographic gear, blankets, rice, tea, cigarettes and one big pot to cook in.

Our jeeps were jammed when we pulled out of Shiraz. We drove all day, refueled at Neyriz, and went on East. The road got worse and worse. At dusk we spotted two porcupines in the headlight beams. We hopped out of the jeep and ran them down, clubbing them with rocks to save our ammunition. Unsporting, yes, but without meat a hunting camp is a sorry group, and we had no idea of the morrow's luck. Porcupine meat is wonderfully sweet and tender, especially when cooked à la herdsman in a crock with rice.

Later that evening we went through the pass in the range of mountains in which we were interested. The plan was to descend to the foothills and the arid plain below, look for tracks and waterholes, and plan our hunting accordingly.



We made our camp in the garden of a ruined mud village nestled in the foothills of the range, quite close to the immense plain.

In the morning Narcy, Fereydoun and I were quite impressed with the idea that we had three villagers to feed besides ourselves. We took an empty jeep and started down to the plain. About half a mile away, on the edge of the plain we spotted a group of six gazelle. They had, we found, an uncanny sense which in spite of our extreme care led them to invariably graze away from us. They never ran, never seemed to look at us, but the three of us never got closer than six hundred yards or so.

Narcy decided to go on by himself while Fereydoun and I waited. I started to poke around in the narrow trench we were sitting in, and I noticed some tracks and some droppings on the bottom. I pointed them out to Fereydoun, who didn't seem overly interested.

"I was afraid you'd see those," he said. "They're Wild Ass, and now we'll have no peace until you photograph them, will we?"

"Well," I said. "We don't have to photograph them, but it would be interesting to see them feeding."

"We can start out as soon as we have a couple

Our new Onager is still a wild animal and he lets nobody forget it. Get just a little too close — as the Zoo photographer did when making this picture — and he lashes out with his heels.

of days' worth of meat. But I have to warn you. They're rare. We may look for a week and not see one."

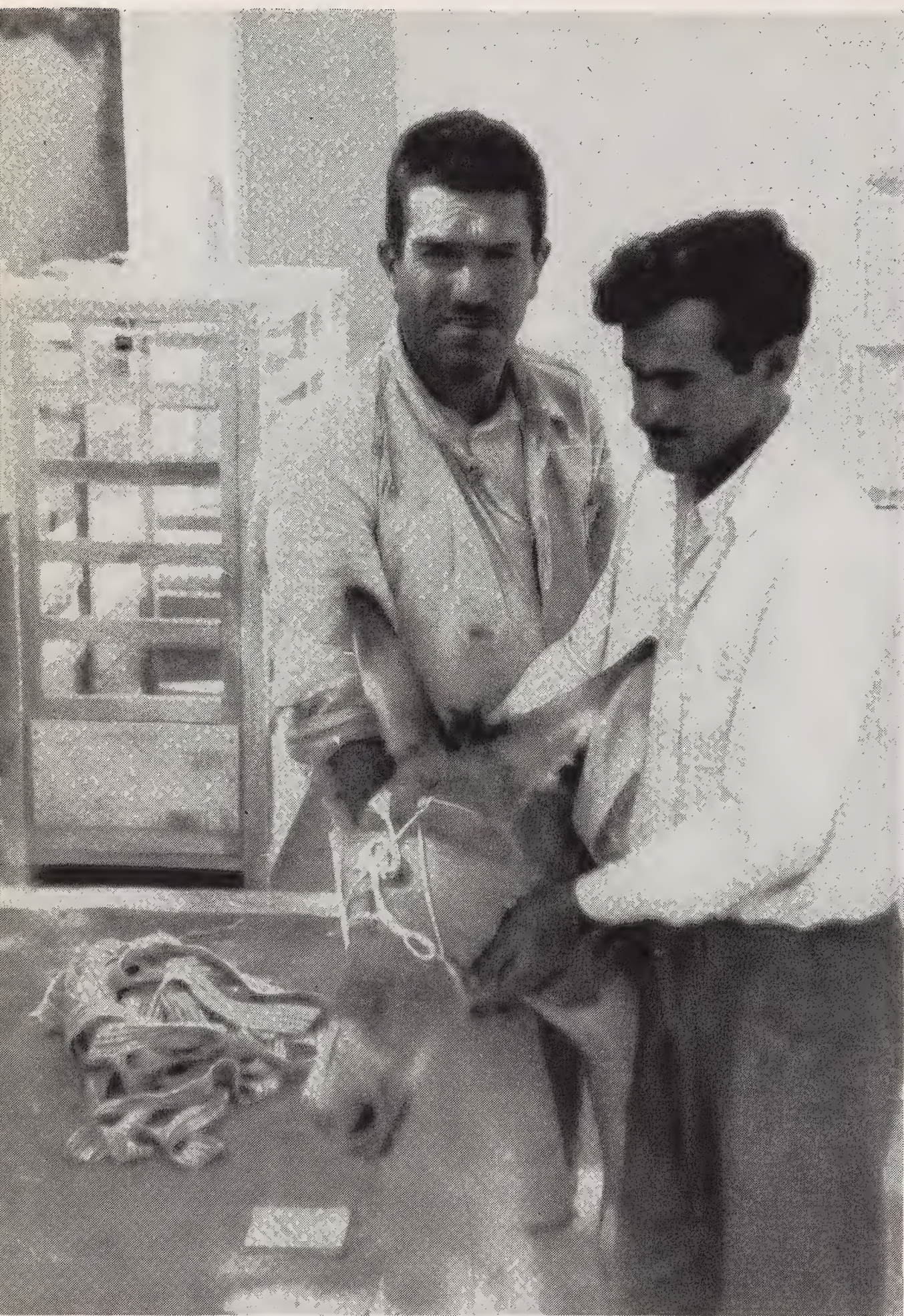
"Will Narcy be game?"

"He'd go out after a unicorn, if you told him there was one around."

We heard a shot and jumped up to see Narcy, half a mile away, running up to a wounded gazelle. Later that day I made a clean kill, and in the evening Fereydoun shot a fine six-year-old. We had our meat, and we could look for Wild Ass.

We sat around our fire that night and talked about the animals. Fereydoun had seen them on the Dasht-e-Kavir, the central desert of Iran. We drank Mahksouse, a local vodka, sang a few songs, and turned in early to get an early start the next morning.

We started out in two jeeps, one carrying Fereydoun, Narcy and me, and the other carrying two men, gas, water and a day's supplies. The sun was very hot and a dry wind came down the



plain, carrying sand and a very fine dust. We worked our way about twenty miles down the plain, leaving the cargo jeep far behind us. About twelve o'clock we noticed that the other jeep had its headlights on. Fereydoun turned our jeep around and blinked the headlights. Five miles away we could clearly see a man get out of the jeep and stand on the hood. He waved excitedly, pointing across the narrow plain to the foothills on the other side. Up to then we had been discouraged because, instead of having difficulty finding prints, we found such a profusion on the rainless plain that we despaired of ever making sense out of them. Suddenly we became very hopeful.

Fereydoun swung the jeep toward the other side of the plain. Every half mile or so we stopped to sweep the plain with binoculars. The shimmer from the heat made visibility very poor,

but we kept heading toward the foothills nearest the cargo jeep. I sat in the back seat, hitting the roof with every bump, trying to get our cameras ready to shoot.

We arrived at the first foothill without seeing anything. We were cursing the men in the cargo jeep for a bunch of imaginative old women, when we arrived at the top and saw to the north the dust raised from a large group of animals running. They were heading into the mountains,

Blindfolded so that he could be more easily led, the Onager was finally put into a stout crate in Shiraz and carried by truck to Teheran, where arrangements were made for shipping by air to New York.

and photography was impossible. Our move was to wait until the next day and try to get them onto the plain, where we could chase them in the jeep and photograph them. It was obvious that the Wild Asses spooked quite easily. From time to time we caught glimpses of the entire herd. Our estimates ranged from one hundred to two hundred animals.

The next day we carried no extra gasoline or water, thus lightening the second jeep so it could help us drive the animals on the plain. We returned to the approximate location of the sighting, skirting the foothills carefully, using every watercourse for concealment.

Our luck was good, for around nine o'clock we spotted a group of thirty Onagers grazing near the edge of the plain. Narcy jammed on the brakes of the jeep and reversed to get us into concealment. Our cameras were useless at that range, so we decided to wait until the other jeep came up, put a villager at the wheel of each jeep, and go camera stalking on foot. We would get in between the animals and the hills, so that, when they took alarm, they would try to cross the plain. We would then signal the jeeps to pick us up, and from the cars we would try to photograph them running.

Unfortunately we had no telescopic gear for the cameras, so we would have to stalk within less than a hundred yards to get a shot. Our hopes were short-lived. At about four hundred yards, the leader caught some of our motion. The group wheeled and headed for the plain. But we had seen five or six young, and Narcy sug-

gested trying to capture a colt or two and really getting a good look at them.

We signalled the jeeps. When they came we took off in pursuit of the animals. One jeep we deployed to keep them from heading back into the hills, for we had a run of about five miles to catch them before they reached hills.

The asses tended to cross from one side of the jeep's path and then cross back when being pursued. The colts were a little slower, which was very convenient, for when we approached the running group, the older animals left the colts behind in a spurt of speed. We got one colt on the right hand of the jeep. Narcy stepped on the gas and turned slightly to the right. I was in the back seat taking scores of photos, all of which I regret to say are distinguished by a universal blurriness. Fereydoun reached out and grabbed the ass's tail. Narcy applied the brakes. I expected the tail to pull out of its socket, but the jeep came to a stop with no casualties except to Fereydoun's hand, which was abraded slightly.

Narcy jumped out and threw his arms around the neck of the colt. With a heave, he pulled its front legs off the ground, so that it was then quite helpless, even though Fereydoun let go of the

tail. It could walk around in a tight circle, but could not buck. It kept trying to bite, with only a little success. By the end of the day we had all experienced Onager bites — which were somewhat more convincing than the fly bites to which we were accustomed.

"Do you want to try?" Fereydoun asked me, when the ass was trussed.

I was willing, so I took my place in the hot seat. I tried a different technique. My idea was to hug the colt and let him pull me from the jeep, so as to avoid the strain on his tail. I planned to heave the front end of the animal off the ground, as Narcy did.

The system worked fine, except that when it came to incapacitating the ass by lifting its neck, I heaved and grunted but all I managed to do was to get my feet stepped on. In this manner I was dragged over a considerable area before the animal finally tired. Fereydoun and Narcy came up, and we trussed it quickly.

Keeper George Hinnekamp is determined to make friends with the Onager and the best way to do it is to bring offerings of favorite food. But at first it's a good idea to stay well clear!



All this time, the other jeep had been doing yeoman service keeping the herd of Onagers in the central part of the plain. Capture had proved to be so easy that we hated to abandon the chase, and so we made a shelter out of one of the canvases from the jeeps and set off after the main herd again. At first we had expected to capture one or two colts, photograph them and turn them loose. But our plans changed during the pursuit. We knew that an animal collector had shipped twenty Wild Ass to European zoos, and it seemed likely that we might be able to find homes for these animals. We decided to paddock them in the little town, leave a man in charge, and return to Shiraz where wire service was available.

By the end of the day we had five Onager colts, two female and three male. They had come out of the fray better than we did. Our hands were bleeding, our arms nipped and our feet bruised from their hooves.

In the following days we explored the mountains and the plains, bringing back every day a supply of food for the asses. In the entire plain we found only one moist spot, with a flow of about a cupful an hour. The conclusion is that Onagers, like gazelles, depend on dew for part of their water. The only things we could see that they might eat were thorns, brambles and hard desert plants.

At Shiraz we started looking for homes for our animals, and dispatched a truck to bring them back when we heard that they were wanted by zoos. To our dismay we found that the two females had been appropriated by villagers for breeding. Horse-Wild Ass hybrids are very hardy domestic animals.

The young Onagers were in captivity in Shiraz for about a month while we figured out a way to get them to Teheran, from where they could be flown to any point in the world.

One plan was to drug the ass, subdue the authorities, and fly him to Teheran on the Iranian Airways passenger plane, on which we had booked two seats for a "Mr. Onager." Fortunately before this strategem had to be put into effect, Point Four came to our rescue in the form of an American truck. I took two animals to Teheran with me, one for the Bronx Zoo and one for the Rome Zoo.

In Teheran KLM was holding space for me. The Wild Ass and I left immediately for Amsterdam. After a few days' delay, we flew to New York's Idlewild Airport where Gordon Cuyler, the zoo's administrative assistant, was waiting to meet its new charge. I gave the Onager into his keeping, and as I walked away from my traveling companion, then being loaded into the zoo's truck, I began to feel quite lonely indeed.

New Members of the New York Zoological Society

(Between November 1 and December 31, 1955)

Founder in Perpetuity

Dr. Henry Clay Frick

Founder

Warren Kinney

Patron

Howard Phipps, Jr.
Mrs. Paul Moore

Contributing

Charles J. Ayer
Anson Beard
John C. Blick
Dr. Robert Boggs
Victor Braunstein
Benjamin Brewster
Gregory N. Camp
Christopher T. Chenery
Stewart P. Coleman

Ambassador Philip K. Crowe
Mrs. William K. Dick
Miss Natalie M. Dodd
Miss Ann A. Fowler
Mrs. Edward W. Freeman
Mrs. Fitch Gilbert
Mrs. William A. Hamann
Mrs. Richard Heimann
William B. Heller
Miss Janet Hesse
Austin S. Igleheart

Leon Israel, Jr.
John L. Loeb
Frank J. Manheim
Mrs. Paul Mazur
Mrs. Henry L. Moses
Miss Antonia Munroe
Harold A. Nehrbas
Frank R. Outerbridge
Hugh Porter
Mrs. William P. T. Preston
Wm. P. T. Preston
H. C. Richard
Dr. Conrad M. Riley
Mrs. Peter Schoenburg
Mrs. Henry Sears
Mrs. Nion Tucker
Dr. Jerome P. Webster
Cedric R. Woodward
Howard Young

Annual

Cornelius R. Agnew, Jr.
Mrs. Joseph James Akston
Mrs. Jean P. Allen
Miss Isabelle M. Ayers

Mrs. Antoinette F. Bacon
Chris and Buffy Barlow
Carroll K. Bassett
David Biberman
Dunbar W. Bostwick
George A. Brooks
Mrs. Henry B. Cabot
Cass Canfield
Mrs. John Carlisle
Miss Emily Chauncey
Charles H. Cole
Mrs. Hobart Cook
Mrs. Richard Deutsch
Mrs. F. R. Dick
George W. Foley
Stephen Foster
Master Ralph Fox
Mrs. Yolande Francescatti
Zino Francescatti
Mrs. D. Carl Fricke
Oliver R. Grace
Howard Graff
L. K. Harper, III
Mrs. A. S. Hart
Mrs. Harold D. Harvey
Fred Hecht

Mrs. Peter S. Hopkins
Edwin L. Hotchkiss
Harry A. Hyman
Mrs. Charles Jones
William R. Joyce
Mrs. Jacob M. Kaplan
Dr. Adrian Lambert
William Lee
Mrs. William McCandless
Manton B. Metcalf
Mrs. Ashmore L. L. Mitchell
Nathan Mobley
Mrs. Charles Russell Peck
Bronson M. Potter
Joseph Richter
Mrs. David Rockefeller
Mrs. Edward A. Rogers
Miss Valerie Di Santagnese
Dr. Edward F. Schortman
George I. Schwartz
Timothy Jay Secor
Dr. Jack Sheps
John Sloane
George R. Squires
Miss Dorothy A. Treat
Mrs. Kenneth Ward

News from the Conservation Foundation

Radio Series Starts February 15

"Today and Tomorrow," the Conservation Radio series of thirteen weekly broadcasts jointly sponsored by the National Broadcasting Company and the Conservation Foundation, will commence on the National network, with the exception of New York City, on Wednesday evening, February 15, and run from 10:30 to 11 p.m. Over WRCA in New York the series will commence Sunday, February 19, and will be on the air from 6:35 to 7:00 p.m. The series will continue on succeeding weeks on the same days and hours.

Crop Yield Research

A new investigation into the many factors which affect the scientific effort to increase crop yields has been initiated under the direction of Prof. Theodore Schultz and Prof. D. Gale Johnson of the University of Chicago. At the outset the study will concentrate on limited geographi-

cal regions where efforts to increase the yields of specific crops have been in progress for several years. Existing records show what has been accomplished in increasing the volume of production. However, variables of soil, climate and other natural factors have not as yet been correlated with the efforts to step up quantity production. It is hoped that the result of this research will add substantially to the knowledge of agricultural potentials.

Educational Opportunity

The report by Dr. Charles Lively on the scope of conservation teaching in the colleges and universities of the United States, including an evaluation of teacher attitudes and methods, has indicated the value of further studies not only at the elementary and high school levels along similar lines, but in the direction of student attitudes and comprehension in the various scholastic grades. Dr. Paul Brandwein has been retained as a con-

sultant for the planning and direction of these new studies of the status of conservation education in this country.

“Prosperity Beyond Tomorrow”

A new book bearing the title “Prosperity Beyond Tomorrow,” written by Samuel H. Ordway, will be published by the Ronald Press on February 14. It examines the implications of industrial progress, automation and increasing leisure in relation to the limited resources available, and the impact of the future on man’s relation to his environment. Fairfield Osborn has said that this book is “A bold and exciting examination of the ways in which we may be able to

sustain our natural and spiritual resources.” Vannevar Bush says “It is a refreshing book because of its objective treatment and its cheerful approach to some of the tough problems that we face.”

Conservation Television in Canada

Twenty-six programs made up in large part from our educational films on soils, forests, water and “The Web of Life” motion picture series have been purchased by Canadian television producers for Canadian broadcasts this year. A substantial offer for the United States television rights to these films has been received but negotiations have not yet been concluded.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Chimpanzees As We See Them— A Guide to Identification

WHEN A NEW Chimpanzee arrives from Africa, the Zoological Park’s first consideration is the state of its health. That is the job of the Veterinarian. But while he is making his routine examination, the Curator of Mammals is an interested spectator. *He* has the responsibility for saying what kind of Chimpanzee it is, and if the animal is still a baby, the determination of its subspecies can be extraordinarily difficult. A baby may show characteristics that change radically as it matures.

Probably a majority of zoologists are willing to accept the authority of Glover M. Allen’s “Checklist of African Mammals” and say there are only four kinds of Chimpanzees in central and west Africa — two species, one with three races. Originally, of course, these divisions were worked out by systematists who described the animals scientifically on the basis of internal characters. Zoo men, looking at a living animal, have no such convenient yardstick.

Nevertheless, over the years, we think we have established valid criteria. To publish them in cold

type, as we are doing now, calls for more than a little courage; this is what is known as “sticking one’s neck out.” It is, at any rate, what we believe and what we act on when a Chimpanzee has to be identified.

BLACK-FACED CHIMPANZEE. *Pan troglodytes troglodytes* (Blumenbach). Has smaller and darker and less protruding ears than the White-faced. Between the ears, the skull is flat and broad. The face is black, but the nose and muzzle are white, and it sometimes has white eyebrows.

WHITE-FACED CHIMPANZEE. *Pan troglodytes verus* Schwarz. This Chimpanzee has a high, narrow, domed head, large and protruding ears, and a white face.

SCHWEINFURTH’S CHIMPANZEE. *Pan troglodytes schweinfurthii* (Giglioli). Has a completely coal-black face, occasionally with a few white hairs on the chin. Body hair quite long, so that it is sometimes called the Long-haired Chimpanzee.

PIGMY CHIMPANZEE. *Pan paniscus* Schwarz. Rare in collections (we have had only one, briefly, in 1923). Small, slender, long-legged — has much the appearance of a Spider Monkey without a

tail. Face is black, nose and muzzle pinkish-white.

At the present time we have excellent specimens of Black-faced and Schweinfurth's Chimpanzees. At least, *we* think so!—LEE S. CRANDALL.

Record Reptile Collection

While sheer size is not the only index of the value and interest of a zoological collection, there is a certain value in having a large and therefore varied display of animals. Our Reptile Department is in the happy position of being able to report that on December 31, 1955, it established a new high inventory for the New York Zoological Society, with 234 species and subspecies of reptiles and amphibians in the collection. The previous high was in 1909 when we had 197 named forms. We do not, as a matter of fact, expect to hold the collection so high, since a figure of nearer 200 forms is better suited to the carrying capacity of the present Reptile House.—J.A.O.

Baby Florida Otters?

Small sounds coming from the den of the Florida Otters in early January indicate that cubs have been born. We are likely to know very little more about them for some weeks, since otters are extremely touchy about interference with their offspring, and the keepers are under instructions to leave the family alone until the cubs emerge on their own account.

Another Young Gibbon

A White-handed Gibbon baby was born in the Great Apes House on December 29 and is the sixth offspring of our pair received in September, 1942. It appears to be a healthy infant and is being carefully nurtured by the mother, with interest shared by the father and another youngster born on August 13, 1953. The sex of the baby has not yet been determined and up to now it is known simply as "Baby."—G.D.

Our King Cobras Courting Again

Last year our King Cobras made zoological history by being the first to reproduce in captivity, laying 30 viable eggs of which nine hatched.

Early in January the beginning courtship was observed again, and on January 16 and 17 Staff Photographer Dunton obtained motion pictures in color of the entire courtship and mating, a scientific record of considerable interest to herpetologists. The next step, presumably, is egg-laying, which we would expect to begin in about six weeks.—J.A.O.

IN BRIEF

More Babies. Two Black-foot Penguins, hatched early last November, have emerged from the downy stage and are visible in the outdoor Penguin Pool. Our breeding colony of Black-foot and Humboldt Penguins is apparently the only one in the country.

Give-and-Get. On a recent visit to the Zoological Park, Karl Plath, Curator of Birds at the Chicago Zoological Park, cast an appreciative and somewhat envious eye on our Guilding's Amazons and European Avocets, species which had not been seen in his collection. Since we had four specimens of each, we sent single birds of both these rare species to the Chicago Zoological Park on an exchange basis, a return to be made when Chicago has a surplus of something we want very much.

Honors and Trips. Dr. Ross F. Nigrelli, Pathologist of the Aquarium, is the new President-elect of the New York Academy of Sciences. Another member of the Aquarium staff, Dr. Myron Gordon, Geneticist, was the speaker at the Alvin Seale Lectureship of the San Francisco Aquarium Society in early January, and from California went to Hawaii to look into the biological situation developed by the release into freshwater streams of that Territory of platyfish and swordtails from Mexico.

Armstrong and armstrongi. Keeper Joseph Armstrong, who takes care of the tropical fish for the Aquarium, has the honor of caring for a tropical fish that is named for him. This is the Gold Tetra, *Hemigrammus armstrongi*, a small tropical that looks as if it had been dipped in gold paint.

First Pileated Woodpecker. A Pileated Woodpecker, largest of the northern woodpeckers, was received by the Zoological Park recently from

an up-state resident who had found the bird with an injured wing. It is a female — not as imposingly marked as the male — and the wing was in such bad condition that it is doubtful if the bird can ever fly again. However, it is responding well to treatment. It is the first Pileated we have ever had.

“Fatty” Is Gone. Our old Malay Sambar Deer, “Fatty,” received on July 5, 1929, finally succumbed on December 12. “Fatty” was a favorite with visitors, always eager for handouts of food.

First in 44 Years. A pair of Golden-eyes, the first of these ducks we have exhibited in 44 years, may be seen in the Large Flying Cage. They were hand-reared by an aviculturist in Pennsylvania from eggs collected in Canada.

PUBLICATIONS OF INTEREST

THE WINDWARD ROAD. By Archie Carr. xvi + 258 + viii pp., 17 plates and 3 maps. Alfred A. Knopf, Inc., New York, 1955. \$4.50.

Readers of ANIMAL KINGDOM have already savored some of the flavor of “The Windward Road.” “The Riddle of the Ridley,” which appeared in the September-October issue for 1955, forms the first chapter of this delightful book and in a sense it suggests the nature of the remainder. “The Windward Road” is primarily an anecdotal account of the author’s quest for knowledge about sea turtles. Except for the first and last chapters, the turtles remain in the background while Carr relates in vivid and colorful detail his adventures on the lonely Caribbean beaches and in the thatched huts of the turtle-hunters.

Archie Carr is unquestionably one of the ablest naturalists of our time. He is a keen field man, a good biologist, a respected teacher, a man with great zest for life and a rare gift for colorful writing. All of these abilities combine to give this book unusual charm, as well as scientific authenticity. “The Windward Road” will be read by some for recreation and by others for information on turtles, but all will read it with real enjoyment. — J.A.O.

STUDIES OF THE PSYCHOLOGY AND BEHAVIOR OF CAPTIVE ANIMALS IN ZOOS AND CIRCUSES. By H. Hediger. Translated by Geoffrey Sircom. 30 illus. from photographs, in black and white. 166 pp. Butterworths Scientific Publications, London, 1955. 30 shillings.

Originally printed in Switzerland under the title “Skizzen zu Einer Tierpsychologie im Zoo und Zirkus,” this is the second of Professor Hediger’s challenging books to become available in English. The rather cumbersome title, almost as forbidding in translation as in the original German, should not act as a deterrent, for the contents are not only completely readable but broadly informative and at times even amusing.

The author’s thesis is a plea for more extensive work in animal psychology or comparative psychology, based

on the whole animal in nature, or at least in natural surroundings, not merely in a maze box. He points out that of the thousands of species of mammals and birds, the white rat, the chimpanzee, the dog, the hen and some gulls, ducks and pigeons, have been most closely examined. His own contributions, in the present volume, he describes as “merely fragments — scattered and unpretentious tesserae.” The reader, however, will hardly agree with the author’s modest comment, for this book contains an immense amount of factual material, of great value to both animal psychologists and zoo operators, gathered under chapter headings calculated to enhance their impact. All have to do with the actual lives of animals, with emphasis on psychological aspects.

Accounts of the trained Chimpanzees at the St. Louis Zoological Park and of the Porpoises kept at Florida’s Marineland, are hardly surpassable. The humility with which Professor Hediger describes a soaking with water squirted from the mouth of a Chimpanzee at the Orange Park Laboratory, gives a graphic impression of the sympathetic understanding of animals that has brought him success as Director of the Zoological Gardens of Basle and Zurich and endeared him to his colleagues the world over. — L.S.C.

PET ALLIGATORS. By Carl F. Kauffeld. 24 pp., text and illustrations by the author. All-Pets Books, Inc., Fond du Lac, Wisconsin, 1955. \$.35.

This booklet is another product of the policy of All-Pets Books, Inc., to provide authoritative accounts of the care of specific pets. Carl Kauffeld, Curator of Reptiles of the Staten Island Zoo, is well-qualified to advise pet owners on the care of their pet Caimans and Alligators. The booklet contains many valuable and practical suggestions for the proper treatment of these animals. — J.A.O.

THE REPTILE WORLD. By Clifford H. Pope. Pp. xxv + 325 + xiii, illustrated with 233 plates. Alfred A. Knopf, New York, 1955. \$7.50.

In a recent history of the science of herpetology, Karl P. Schmidt pointed out that the Ditmars era had lately come to a close and that the Ditmars books had been or were being replaced by more modern works. Clifford Pope’s new book, “The Reptile World,” lends support to Schmidt’s statement. It clearly replaces Ditmars’ “Reptiles of the World” and does so in many ways. In this connection it is interesting to note that Pope expresses his indebtedness to Dr. Ditmars, “whose works, now classics, first stimulated” his interest in reptiles. This same acknowledgment can be made by virtually every professional herpetologist in this country today, for Ditmars, for 38 years Curator of Reptiles at the Bronx Zoo, did more to stimulate popular interest in herpetology than any other individual.

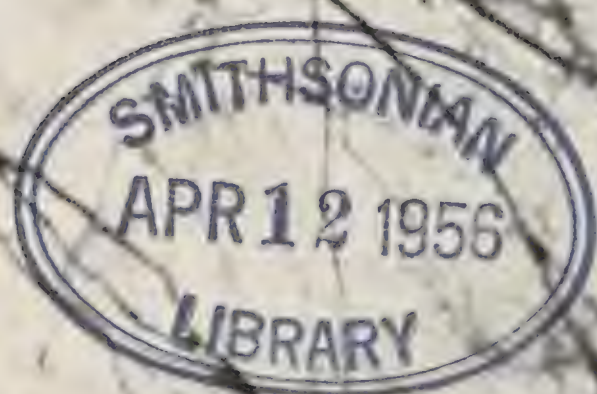
“The Reptile World” is an excellent popular book. It covers all the groups of living reptiles, giving interesting information about their ways of life and their classification among the other reptiles. Crocodilians are discussed first, then the Tuatara, the Turtles, the Snakes and finally the Lizards. At the end of the sections on each major group there is a bibliography listing publications in which the interested reader can seek further information on specific subjects. One of the most useful features of the book is its excellent photographs. The organization is good and is designed to give a lot of information about each group. — J.A.O.



It's still a bit early for baby Robins but it's just the right time to invite your friends to join the New York Zoological Society and share the spring fun. Use the postcard. That's what it's there for.



ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT Fairfield Osborn	VICE-PRESIDENTS Alfred Ely Laurance S. Rockefeller	SECRETARY Harold J. O'Connell	TREASURER David H. McAlpin
--------------------------------------	---	---	--------------------------------------

EXECUTIVE COMMITTEE

Laurance S. Rockefeller <i>Chairman</i>	<i>Class of 1956</i> Archibald S. Alexander A. Raymond Dochez Robert G. Goelet De Forest Grant Eugene Holman Warren Kinney William De Forest Manice Harold J. O'Connell Landon K. Thorne J. Watson Webb
George F. Baker, Jr. John Elliott Alfred Ely Robert G. Goelet De Forest Grant David H. McAlpin Robert Moses Harold J. O'Connell Fairfield Osborn Edwin S. Webster, Jr.	

BOARD OF TRUSTEES

<i>Class of 1957</i> Robert E. Blum Percy Chubb, 2nd C. Suydam Cutting Alfred Ely Marshall Field Childs Frick Henry Clay Frick David H. McAlpin Richard C. Patterson, Jr. John H. Phipps	<i>Class of 1958</i> George F. Baker, Jr. F. Trubee Davison John Elliott Robert I. Gannon Peter Grimm Fairfield Osborn Eben Pyne Laurance S. Rockefeller John M. Schiff Henry Sears Edwin S. Webster, Jr.
--	--

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Richard H. Manville *Curator, Mammals*
Grace Davall *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandal *Assistant Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch *Assistant Curator, Education*
Quentin Melling Schubert *Superintendent,*
Construction and Maintenance
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. *Research Associate in Ichthyology*
Harry A. Charipper *Research Associate in Histology*
Homer W. Smith *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory
John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez
Alfred E. Emerson
W. A. Hagan
Caryl P. Haskins
K. S. Lashley
John S. Nicholas

AFFILIATES

C. R. Carpenter, Co-ordinator
Animal Behavior Research Programs
L. Floyd Clarke, Curator
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen
George E. Brewer, Jr.
John C. Gibbs
Samuel H. Ordway, Jr.
Hugh J. Ross
Robert G. Snider
Peter M. Stern

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

European Red Deer	
<i>Sam Dunton</i>	Cover
My "Komodo Dragon"	
Circus	<i>Pat Collins</i> 34
Anteaters	<i>William Bridges</i> 43
Zoo Picture Pages	
<i>Photos by Sam Dunton</i>	47
The Bird's Nest As a Dormitory	
<i>Alexander F. Skutch</i>	50
A Rare Gift: The Guatemalan Boa	
<i>James A. Oliver</i>	56
In a Way, the Lungfish Is a Missing Link	
<i>James W. Atz</i>	57
Zoo Tours	60
News from the Conservation Foundation	61
Behind the Scenes	62

Vol. LIX APRIL No. 2
 1956

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

Spring—Here and There

IT'S HERE NOW — this green, bursting, growing, singing season. Down in the southlands it all happened a month or more ago. Up in the northlands, or in the high mountain fastnesses of the far west, it is still winter and not until mid-May will the waiting earth be freed from its prison-cloak of ice and snow.

How wonderful is the adaptation of animal and plant life the world over to the imperious forces of climate! In these mid-latitudes and those of the southlands birds go about their primal affairs of nesting and rearing of young with a fine show of activity but with ample time ahead for the young to grow and be ready for their migrations southward in late autumn. Plants emerge from their earth-covering with long months ahead for growing, flowering and seeding. So with mammals and reptiles, there is no great rush. The young will be ready, the coming winter is still far away. Not so, not so at all, in the far north or in the high mountain regions of the west. There every hour counts, for the period from birth to life-readiness is so brief.

One day I stopped to watch a road gang building a highway over Togwotee Pass in Wyoming. "You fellows seem to be pushing pretty hard," I happened to remark to the foreman. "We gotta," he replied with a trace of a smile, "there's only about sixty-five days a year up in this country when the weather lets you get at a road."

The road can be finished next year, I thought to myself, but for the plant and its seeds and the animal and its young there is no other year. Finish the job, have the new generation ready — or the species dies.

Fairfield Osborn

APR 11 1956

My "Komodo Dragon" Circus

By PAT COLLINS

Area Specialist, United Nations Secretariat



cus stunt. As for the success of the entertainment, it was complete. Both the dragons and I enjoyed it immensely.

Less whimsically, I should explain that in 1937 I was cruising in the waters of southeast Asia. I had leisure, a little money from books and articles, and a desire to sail to tropical islands. I had no particular intention to go to Komodo or any of the other nearby islands that are famed chiefly for the giant lizards (two of which are now in the Bronx Zoo), but headwinds forced me to take my small motorless sailing ship to this area, some two hundred miles off the course I had originally planned. What I had read of the great reptile *Varanus komodoensis* made me want to meet him. This was too good an opportunity to pass up, and so I stopped for a visit — and stayed five months.

When we anchored off the north end of the twenty-mile-long island, we were under towering red cliffs with patches of yellow and white — cliffs that seemed to glow with incandescent heat in the light of the setting sun. Cliffs, I found later when I sailed around the island, formed 45 per cent of Komodo's coast. In the south and

The author's ship "Bintang" here lies off West Flores. The island of Rintja is at the extreme left, and Komodo is low on the horizon at the right, between two small, steep-sided islands.

All photographs by the author

I AM, it seems, the only man who ever gave successful circus performances with dragons. I hasten to add that they were merely dragons-by-courtesy, and the circus was a private affair for my own entertainment. Nevertheless the designation is accurate, for the great monitor lizards of the Indonesian island of Komodo *are* popularly called dragons, and inducing them to jump through hoops is certainly a legitimate cir-

southwest, battered by heavy seas from the Indian Ocean, the coast is nearly all cliffs. Inland there are few level areas. There is a plateau in the central hills, some valley bottoms and small coastal alluvial fans below the steep ravines. Not, really, an attractive landscape, for the greater part of the island is covered with grass and most of the rest, mainly in the central hills and along the larger watercourses, bears little except an extremely

thorny forest. It is a fit habitation for deer and pig — and monitors. Mankind is restricted to a small village on the southeast coast.

When it was clear that our new course would take us to Komodo, I wondered how I could get bait to attract the carnivorous lizards. Landing would be more convenient at the north of the island, and the only village was on the other side of rugged, 2,400-foot central hills, so the local people would be no help in getting bait. However, though I had no firearms, I had an air rifle — brought along not to kill anything, but for shooting at coconuts set afloat when the ship was becalmed — and on a small island not far from Komodo I went ashore and shot 52 big bats (“Flying Foxes”) and sailed merrily ahead with a hundred pounds of bait slung from a boom astern. The next day, under the blazing sun, the bats gave off a strong odor that quickly became worse and worse. The wind dropped, and before we got those bats ashore the ship had drifted for five long and nauseating days and nights.

During the long dry season on Komodo the watercourses are empty and the soil is parched until the December-to-March rains come. We arrived in the dry season and found no water, even

after digging several feet. The hard-baked mud of a dried-out waterhole was full of footprints of deer and pig — there were also claw-streaked footprints and the wavering tracks of “dragon” tails.

Two of my sailors carried the bundle of decaying bats inland, where we rigged up a boom and hoisted them aloft so that the wind would carry the message to the monitors to “come and get it.” They came, for they relish meat either fresh or fetid. When a small one showed up, I would lower the boom and let him eat, but raised it when a larger lizard threatened to swallow all.

At first I used to watch the lizards from the ground and at sundown hoisted myself in a tree to sleep, for I had read that the monitors were active at night. Later, when I found that they always went home at sundown and that the Komodo hunters slept on the ground in the open, I did the same. The monitors stay home at night because they rely very much on their keen sight and very little on hearing. I used to carry fire-

These are the four “regulars” that came to the bait in Vai Liang Valley—said to be the largest lizards on Komodo. Presumably they were about ten feet long. They were impressive because of their bulk.





“Dragon” tracks. The wavy line in the center was made by the tail, the holes at the side by the feet, and the curved marks by the loosely-hanging claws. Author’s tracks are at outside.

crackers in my ship for Indonesian celebrations such as weddings — the noise is believed to drive away evil spirits — and the roar of dozens of big firecrackers, a real Fourth of July broadside, did not disturb feeding monitors in the least. Yet observations made at the London Zoo showed that their monitors reacted to certain sounds, such as the voices of keepers.

I had read that Komodo Monitors grew to a length of 23 feet, and as the largest I had seen were less than 10 feet long I sailed to a bay nearer the central hills to look for real monsters — at the same time hoping to find more bats and also water, for the ship’s supplies were running low.

Here we found two groups of hunters from neighboring large islands who agreed to kill wild pig for me and showed me a spring.

To test the monitors’ climbing abilities, I hoisted a dead pig at the end of a tree-trunk boom. Very young monitors can climb trees like cats, and they walked to the bait easily. But the older the lizards were, the harder they found it to navigate on a slanting tree trunk. A fairly heavily-built monitor tried but fell off at once. And the more a lizard ate and the fatter he grew, the harder it became to walk the boom and get more food — it was a fair and efficient form of rationing. Sometimes I put a pig on the ground to see



how they would tackle it. When a large monitor begins to eat a pig, he usually plants all four feet firmly on the ground, swings his body forward, digs his inward-curved teeth into the carcass, and then swings back, tearing off a mass of hide and flesh — like a battering ram working the wrong way. He twists off a leg by grasping it in his jaws and moving round and round the pig until it comes loose. Monitors can swallow whole legs and also, if there are no protruding tusks, pigs’ heads over a foot long. They will eat any animal

matter, either fresh or decomposing, and several observations made me think they will take only animal matter, for I noticed that when they were feeding on a deer's internal organs and happened to eat masses of half-digested vegetable material, they disgorged it. On the other hand, I saw an old, heavyweight monitor twice strip the leaves from a branch of a shrub. I have no idea why he did it, or what the shrub was, nor could I tell whether the lizard went on to swallow the leaves.

On our way to the lizards each morning, through tangled forest with thorny lianas hanging in fantastic loops and spirals, pig and jungle fowl would run off ahead. There were many pigeons



A young monitor lying on the branch of a tree, having climbed up there when frightened by a large monitor. Young ones climb with the ease of a cat, but this ability declines with age.

and other birds, including flocks of screeching yellow-crested cockatoos. Wearing only swimming trunks and shoes, I got scratched. Flies commuted between the dead pigs and my scratches until a poisoned leg made me suspend dragon-watching and sail to Flores for hospital treatment.

Dragon-watchers may also be warned about jaundice, which I got when I went back to Komodo.

When I arrived at the hospital the local government officer told me that the hunters we had met were poachers and that hunting in Komodo by anyone but the permanent inhabitants was prohibited, to protect the deer which form a major part of the monitors' food supply. The other large animals available are pig and buffalo in Komodo and Rintja, and in Rintja there are also wild horses. The monitors may wait for pig and deer in scrub or long grass by animal-trails, or in waterholes with just their eyes and nostrils above the water. The monitor may leap at his prey and hook his teeth into it, or use his tail as a weapon. Even the most heavily-built dragon can turn quickly and strike a smashing blow with his powerful tail. Other food sources are monkeys (in Rintja only), rats, small species of lizards, turtle and megapode eggs, dead marine fauna and seabirds cast up by the sea, and — for monitors of tree-climbing age — eggs of tree- and cliff-nesting birds.

What preys on the monitors? If we except possible disease bacteria and parasites, and burrowing lizards, snakes or insects that may eat monitor eggs after the female has buried them in the ground, the answer seems to be "only man." In the nineteen-twenties some monitors were killed by non-Indonesians from Sumbawa to make "medicine" from their tails. The Government soon stopped this slaughter, but man as a hunter of deer remains a threat to the lizards. The numbers of the big reptiles are also reduced, directly and indirectly, by the burning of grass in the dry season. Local hunters say it is good for the grass, but it does far more harm than good by destroying animal life and the protective vegetation which guards the soil against erosion.

After two months of hospital treatment I went back to Komodo. This time I wore long trousers and leggings made of sailcloth, and also, when watching monitors, a shirt to keep off flies. It was not until after I had finally left the island — more than five months in all — that my leg healed.

The Komodo people, numbering about 150, have their own language, but as some of them knew Indonesian we could discuss the monitors. When I put down two sticks 23 feet apart and said that some people claimed to have seen lizards



this long, they laughed. They put the sticks about ten feet part and said "That's as long as they grow." The origin of the 23-foot monster I learned later. P. A. Ouwens, writing the first scientific description of *Varanus komodoensis* in 1912, described a skin nine feet six inches long and added that some pearl shell fishermen had said they grew to 23 feet. Since then only a few expeditions have visited Komodo. The leaders of two of them claim to have seen 23-foot lizards, and one of them stated "There are also dragon-lizards thirty feet long." Other outsiders, like the Komodo residents, say they have seen lizards only up to ten feet. Some time after I left Komodo, a diver who had been there with the pearl shell fishermen told me that his party "never saw any twenty-three-foot lizards. It was just a hoax." After all these years, the hoax is still enlarging the monitors — as late as 1953 an encounter with an impossibly large lizard was reported.

The longest specimen of *Varanus komodoensis* known to science measured ten feet two inches. But build, not length, is the best measure for comparison of monitors. The lizard begins life

with a slim body and head and a very long, thin tail. Through the years he changes shape until he has a massive body and head and a short, thick tail. In the final period of his life he does not seem to become much longer, but grows broader and more massive. Comparison of length is also less useful because of the monitor's habit of hitting other animals with his tail so hard that the tip breaks off.

The Komodo people knew of only two occasions in recent decades on which a monitor had attacked man. One of them told me how as a boy he and two others had been chased by a big lizard, which caught one of them and killed him. On the other occasion a monitor attacked two men and wounded one of them before they beat it off. The local hunters said they kept together when returning from a hunt with a dead deer — which they usually cut up to make it easier to carry — and that it was unwise for a man alone to carry

The landscape of Komodo is not attractive. This is a view from the central hills across the valley to the bare northern range.

An old and heavy-bodied monitor crossing the dry bed of the Vai Liang where many of the larger lizards were to be found.

venison or a fresh hide. (I used to carry a spear on rambles around the island, but never had occasion to use it).

They told me that the biggest lizards in Komodo lived in the country around Vai Liang, a large watercourse, and this area became my main field for dragon-watching. Since monitors were plentiful there, I tried to find out what they did under natural conditions, without bait, by following them in the hope of seeing them catch deer or pig. They spent much time just sitting — like a dog, with hind legs bent and fore legs straight. I never saw one catch anything. Often I lost them when they went through thick undergrowth where I could not follow. But I went home with some of them and photographed them outside the caves (under rocks) and burrows (dug in sandy slopes) where they live.

It was, incidentally, while I was setting up a

photographic blind that I noticed something that perhaps should be mentioned. I had read somewhere that Komodo Monitors have a strong, distinctive odor. One report even said you could smell them aboard ship at anchor when there was an off-shore breeze. I had not noticed any particular monitor odor — only dead bats, in the early days — but while cutting bushes to set up my blind in front of a lizard's cave I began to notice a pungent smell like that of an ill-kept Lion House. Optimistically I went and sniffed at the entrance of the cavern, but there was no odor there. Soon I discovered that it came from some of the bushes I had been cutting.

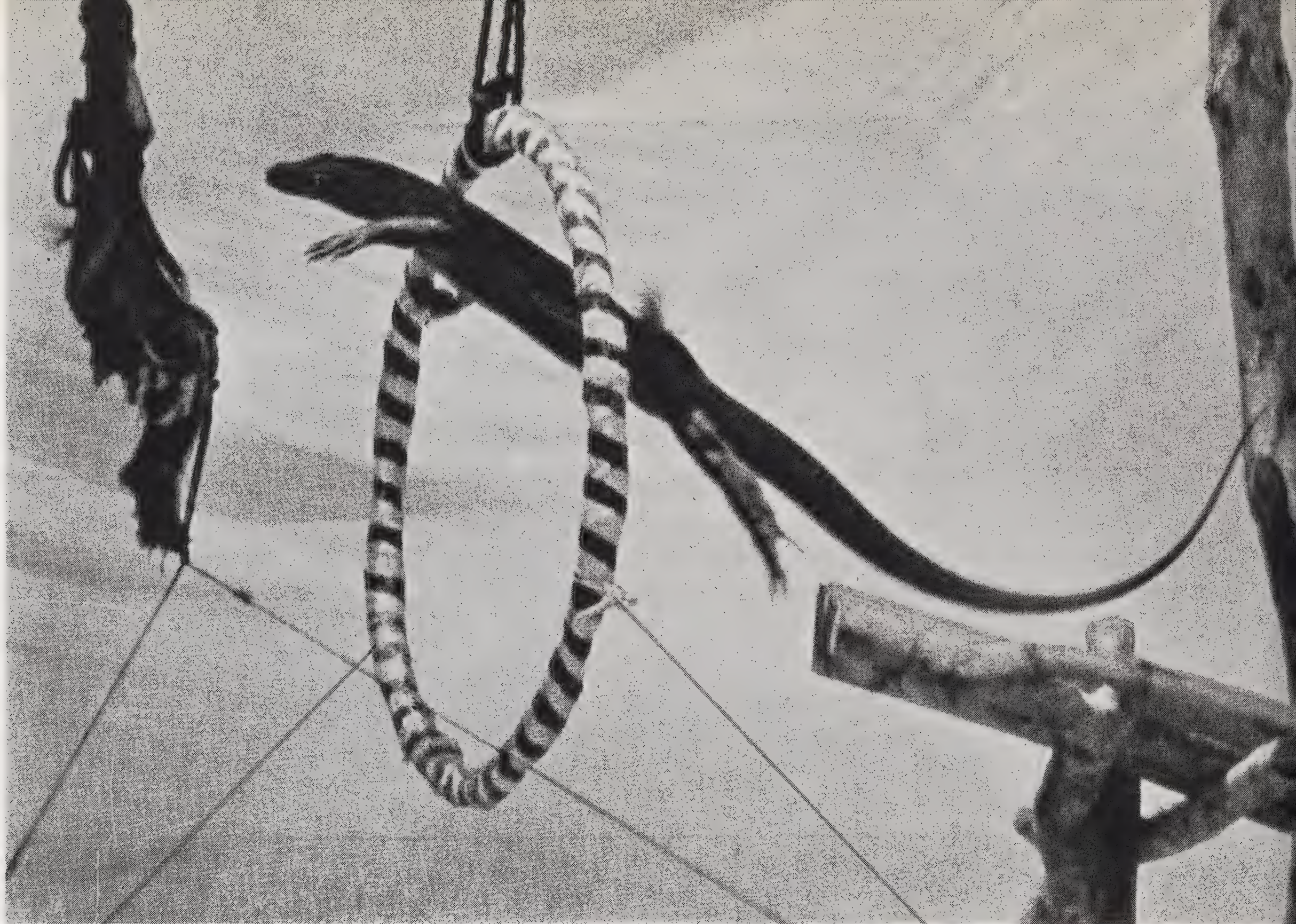
After feeding the Vai Liang monitors at a place where I hoped to experiment with them later, I left them to recover their appetites while I went on trips with hunters to the interior and the other side of the island. We met several bulky old lizards in the central hills, where they have a good food supply in the deer and buffalo that live on the plateau — it is largely covered with short grass cropped by grazing animals.

After these overland trips I went around Komodo in a canoe with four hunters, calling at

many points on the way and making trips inland. One night we landed at a gap in the south coast cliffs and went up a ravine to a spring, where one of the men set fire to the grass. A strong south wind was blowing and the flames raced into the hills. I climbed to the top of a ridge and watched. To left and right, pieces of burning vegetation, carried by cross-currents of wind caused by the hills, skipped across ravines from ridge to ridge. On and on went the fire, blazing up on one hill after another and then dying down, leaving thousands of points of light glowing in the dark. Some sailing directions made about 1903 described a headland in north Komodo as "wooded." There are no woods now. Did the burning of grass destroy them? And in the central hills, surrounded by forested slopes, is a level desert of red rock with white gullies cut deep by rain. Was this desert once covered with grass like the grazing land of the plateau — grass that was burnt, leaving the soil without protective cover?

After going around Komodo I went to the small island of Padar, where live a few deer and still fewer monitors, and then sailed to Rintja (east of Komodo, where there are also monitors) and



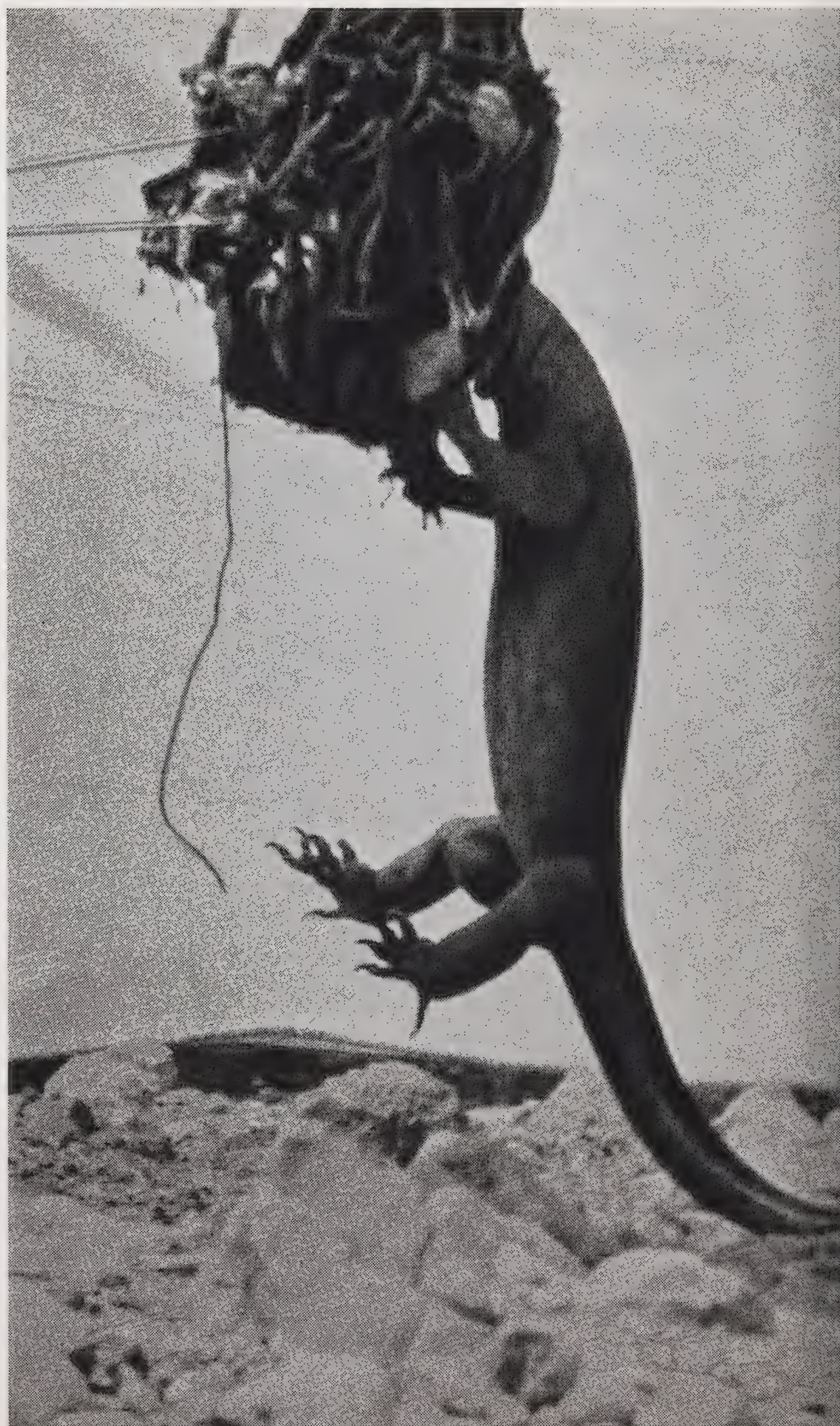


The star of the "Dragon Circus" was this young monitor. It soon learned to climb the logs, leap through the hoop, grab the bait.

This performer has made a leap and is taking a bite out of the meat before dropping down and starting the performance again.

went around that island in a canoe with four Rintja men, who are primarily fishermen and only part-time hunters. The southern part of Rintja — hills largely covered with thorny forest — is a natural reserve for monitor lizards. Since I was there a Dragon Reserve has been formed, consisting of south and northwest Rintja and the island of Padar. Hunting is entirely prohibited in the Reserve, and in all of Komodo and the rest of Rintja it is prohibited except for permanent residents. The Wildlife Service of the Indonesian Government is actively protecting the monitors — recently the head of the Service made an expedition to Komodo and Rintja.

While we sailed along the south coast of what is now the Dragon Reserve I saw a massive old



monitor on the edge of a cliff. Motionless but for the regular expansion and contraction of his throat as he breathed, he was sitting with majestic dignity, stretching out his neck and pointing his nose at the sky as if in disdain of the little canoe below, safe from human beings who would destroy his food supply. Komodo has been called a "lost world," usually in conjunction with reports of the 23-foot "dragons" and statements that the dragon-lizard is a "prehistoric monster" and resembles *Tyrannosaurus*. If any view of a big monitor could have given me a "lost world" impression, this was it. But instead he made me think "That big dragon's world will not be lost as long as man keeps out of it. And man has only to continue war and invitation to erosion to produce a lost world of his own."

The Komodo Monitor, no more "prehistoric" than his *Varanus* relatives, is in build as much like *Tyrannosaurus* as a dog is like a kangaroo. But when you see a monitor eat a pig, you are probably watching, on a scale of one foot to four, the same sort of bloody gorging that took place when *Tyrannosaurus* devoured its prey.

Some of the monitors figured out a better way to get at the suspended bait. Instead of jumping, they climbed out on the horizontal pole.

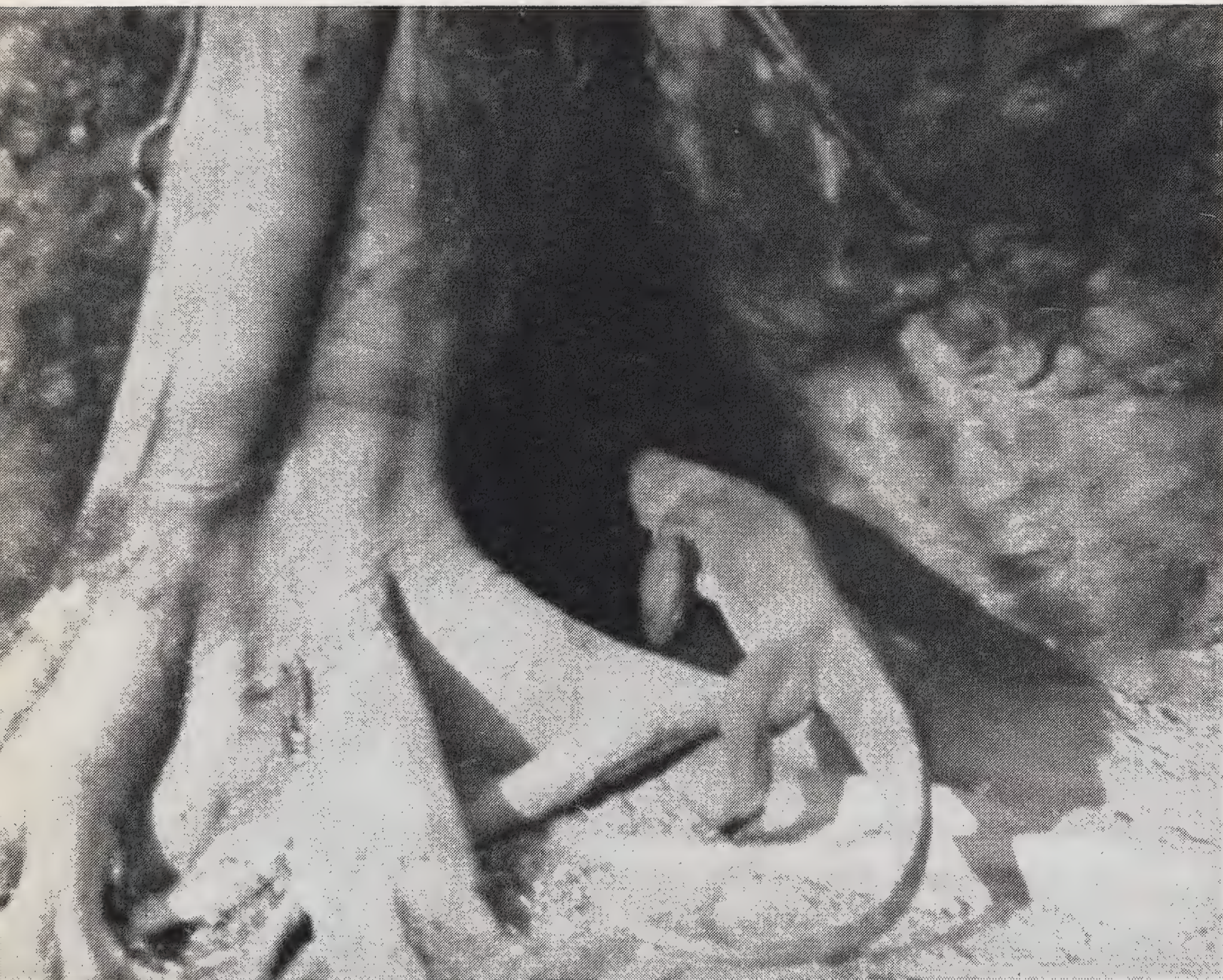


Linked with the "resemblance to *Tyrannosaurus*" are reports of monitors getting up on their hind feet and running in this position. Young ones can stand up in this way but do not appear to walk or run like this. As they grow older they stand up more rarely. The ability to stand up still remained in the largest monitors I watched but they had not done it for so long that it took them several hours and a number of faltering attempts before they could rise to reach bait hanging over their heads. Photographs of heavy old lizards getting up on their hind legs showed that they used their jaws only to grab the hanging bait, not their fore paws. After a time they learned to make use of their claws to hold on to the bait so that they could eat comfortably standing up.

From Rintja I sailed back to the Vai Liang monitors, now hungry again and ready for a new type of rationing designed to test the difference in caution between old and young ones. The place where I had fed them, and where fresh bait was now laid, was in the Vai Liang stream bed where it narrows to about thirty feet between

The really big monitors did not try to climb up to the bait. With considerable effort—and frequent failures—they reared from the ground.





At the day's end the monitors retired to their caves. This one lived under a mass of rock set in a sandy hillside, and shared the retreat with some small bats.

trees that arch and nearly meet overhead. Many times there were more than twenty monitors at or near the bait, including four bulky old "regulars" — said by the Komodo hunters to be the largest in the island. They would make their peculiar deep, hoarse, hissing sound and swing their tails at one another and at middleweight lizards which tried to get at the bait, but they would rarely chase very small ones away. When monitors of various sizes were around the bait and I moved slowly toward them to see how they ran, it was always the same. The largest reptiles departed first and so down the scale of caution to the very young ones, which would continue to eat while I stood right over them. When I waved my hand in front of their faces, they would just look up and then go on with their meal. It may be mentioned here that in all my experiments the monitors were free to come and go as they wished.

By moving slowly toward lizards up to six feet long I could photograph them only three feet away, the shortest distance for which my camera could be focused. But as soon as I left the blind, though my movements were like a slow-motion picture, the old, heavy lizards always spotted me and left the bait. They would go to the undergrowth about twenty feet away and watch, returning only when I had hidden again.

Next I sat in the stream bed behind a sheet of burlap, with the bait between me and one of my sailors with the camera, in the hope that a big monitor would join me in a picture. After a day with me sitting in the sun and the big reptiles in the shade, and no picture, I made a dummy, stuffing a shirt, trousers and cloth head with leaves, and placed it sitting on a rock. After leaving it for a few days for the lizards to get used to it, I took its place, with a dead deer for fresh bait. As I had jaundice at this time, it was unpleasant to be out in the midday sun. At last one of the big monitors approached the bait. The sailor took the photograph a little too soon, but the monitor is just in the picture. I sat for this photograph only after my long stay with the lizards had enabled me to get to know them — when a big monitor with a dead deer seemed less likely to bite than a little dog with a bone. The first big lizard that came near the bats, soon after I arrived in Komodo, sent me up a tree.

Finally, with my ship's mainsail as a backdrop, I rigged up a hoop and by means of bait induced young Komodo Monitors to jump through it one after another. The photographs on pages 40-41 show better than words can tell the story of their distinguished debut in the world's first "dragon circus."



The Tamandua is intermediate in size between the Giant and the Silky Anteaters. This young one recently entered our collection.

ANTEATERS

Become Milk-egg-meat-eaters in the Zoo

By WILLIAM BRIDGES

IT WOULD BE interesting to know the name of the minor genius who first thought of feeding an anteater on milk, egg and finely-ground meat. "Genius" is surely not too bold a term. How many of us — especially if we have ever inadvertently tasted ants at a picnic — would imagine these bland substitutes could satisfy animals that feed largely, if not exclusively, on ants and termites in the wild?

Probably we shall never know the inventor of

that diet, for such details of zoo-keeping are seldom recorded and the origin of this one goes back a long, long time. In the New York Zoological Park we were using the milk-egg-meat formula in 1905, for in that year the late Dr. Raymond L. Ditmars wrote an article about the Giant Anteater in our collection, and noted that milk and egg and the scrapings of meat were keeping it in "a flourishing condition."

The London Zoo had been exhibiting Giant



Anteaters since 1867. There is no hint in London's publications as to how long those first animals lived, or what they ate. Nevertheless, some kind of a substitute for their natural diet must have been in use even in those days, else they never would have survived the long voyage from South America to England by sailing ship. It is all very well for an animal collector to keep an anteater alive in a jungle camp by bringing it ants' nests and chunks of termite mounds daily, but you can hardly carry a big supply of such active food as ants and termites aboard ship.

There are three kinds of anteaters in Central and South America and over the past half-century we have exhibited all of them. At the moment we have the Giant Anteater (*Myrmecophaga jubata*) and the Tamandua (*Tamandua tridactyla*). On only three occasions, two of them many years ago, have we even attempted to show

Some years ago we exhibited a female Giant Anteater and her baby. Long after the youngster was large enough and strong enough to walk alone, it rode everywhere on its mother.

Three typical poses of the Silky Anteater presented to Dr. Beebe at his Trinidad laboratory. When its strongly prehensile tail was wrapped around a branch, its body could be extended in any direction. Eyes tightly closed, its sharp claws were ready for a quick slashing attack.



the pretty little Silky Anteater (*Cyclopes didactyla*). In the experience of most zoological gardens, the Giant Anteater lives quite well on the milk-egg-meat diet; the Tamandua does rather badly; and the Silky Anteater virtually not at all. And yet, in the wild, their natural food seems to be much the same.

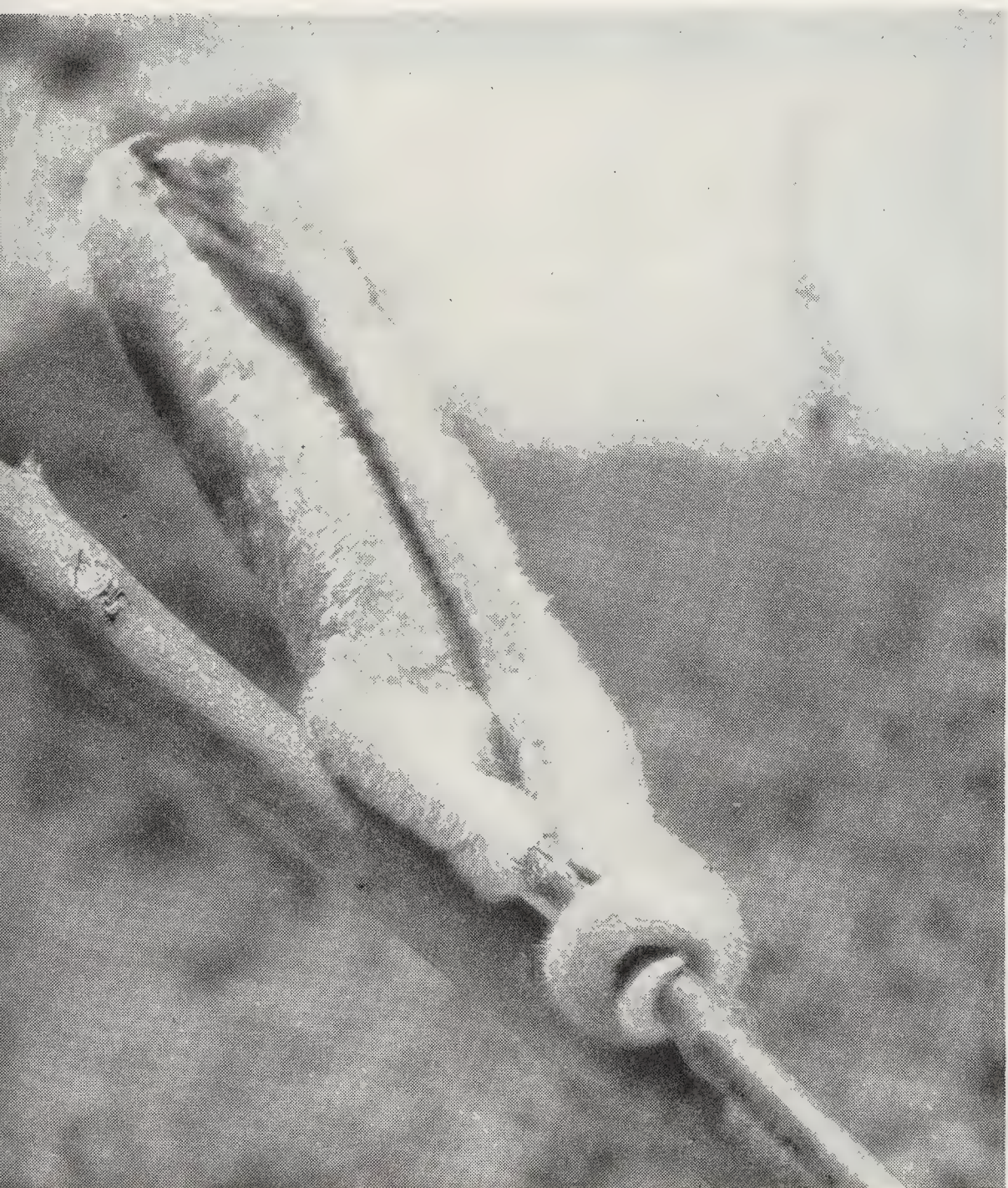
All three of the New World anteaters are toothless; what use are grinding surfaces to creatures whose food consists solely of soft-bodied termites and ants and their larvae? All three have extremely long, narrow and sticky tongues which lap up ants very much as another type of tongue might lap up water. An anteater's tongue flicking over a honeycombed chunk of termite mound, darting into the tunnels and sweeping them clean, is an interesting study in efficiency.

The first Giant Anteater in the New York Zoological Park came to us on May 17, 1899, nearly six months before the formal opening of the Zoo. Most accounts of the animal's life in the wild speak of it as "strictly terrestrial," and it is, therefore, tantalizing to find on the record card of our first specimen a single notation: "Found in a tree (3000 ft) altitude." Nothing else. Not even the country from which it came. The card *does* report that we paid \$40 for the specimen — which

must have been an especially fine one, for a few years later we acquired our second specimen for only \$25. Nowadays the standard price is about \$125. The animal is apparently nowhere really common in the American tropics, but it can be obtained with fair regularity by zoological parks.

All the anteaters are nocturnal, if left to their own devices. By scheduling feedings in mid-afternoon, we make sure that some of our visitors, at least, will be able to see our anteaters in action. But for the greater part of the day the Giant, in particular, is a formless mound of grizzled gray-brown hair. Much of the time the enormous tail is spread to cover the curled-up body. As an exhibition animal it is nothing to boast about when it is asleep, but awake and active it is surely one of the oddities of the animal world.

Without exception the score of Giant Anteaters we have exhibited since 1899 have been inoffensive creatures. The long and heavy claw on the third toe of the front foot is capable of inflicting severe damage on an enemy — its primary purpose is to rip open ant and termite nests and mounds — but the animal does not use it offensively. Given a few days to "settle down" in their new home in the Zoological Park, the Giants readily accept the presence of their keepers, who



can work around them without being menaced in any way.

William Dampier, the 17th Century seafarer and explorer, wrote an entertaining account of the Giant Anteater which he had encountered in Panama:

"The Ant-Bear is a four-footed Beast, as big as a pretty large Dog, with rough black-brown Hair: It has short Legs; a long Nose and little Eyes; a very little Mouth, and a slender Tongue like an Earthworm about five or six Inches long. This Creature feeds on Ants; therefore you always find them near an Ants Nest or Path. It takes its Food thus: It lays its Nose down flat on the Ground; close by the Path that the Ants travel in, (whereof here are many in this Country) and then puts out its Tongue athwart the Path: the Ants passing forwards and backwards continually, when they come to the Tongue, make a stop, and in two or three Minutes time it will be covered all over with Ants; which she perceiving, draws in her Tongue and then eats them; and after puts it out again to trapan more. They smell very strong of Ants, and taste much stronger; for I have eaten of them."

For its time, that was not bad natural history writing.

The London Zoo holds what must surely be the world's record for longevity in the Giant Anteater — 14 years, 4 months and 1 day. Our best record is 7 years, 4 months and 18 days.

London, again, is far ahead of anyone else whose records are available to us in the keeping of the Tamandua. Between 1880 and 1885 it managed to keep one for 4 years, 11 months and 15 days. This was most exceptional, for the average longevity of ten Tamanduas in London Zoo's collection was only 10.8 months. Our own Tamanduas have, over the years, just about matched the London average.

For the greater part of February our Animal Hospital wrestled with a special problem posed by our latest Tamandua. When the animal arrived it was found to be heavily infested with intestinal parasites — a strongylid worm. This is not, in most animals, a cause for particular concern, for there is a modern vermifuge that is specific for these parasites. But how to get it into an anteater?

The vermifuge indicated in the case of our

Tamandua is tetrachlorethylene, which must be given in capsule form. The Tamandua has a tiny mouth opening, hardly large enough to insert a capsule, and its buccal cavity is extremely long and extremely full of tongue. Moreover, tetrachlorethylene requires that the patient be on a fat-free diet for at least 24 hours before and after medication — and milk is an integral part of the Tamandua's diet in the Zoo.

Under the circumstances Dr. Goss chose to administer another vermifuge, phenothiazine, which is less specific but — he hoped — sufficiently effective. Phenothiazine can be mixed with the animal's food, and by giving liberal doses of it on three successive days the Veterinarian was able to rout the parasites. A week after the treatment, microscopic examination showed but a single egg where hundreds had been found before medication. We now have strong hope that our new Tamandua will thrive.

The little Silky Anteater of Central America and northern South America will, unfortunately, probably never be a standard "Zoo animal," in the sense that the Giant Anteater and the Tamandua are. It will eat the milk-egg-meat mixture, but it does not thrive on that diet and a few months are about as long as it can be expected to live. Consequently most Zoos make no attempt to exhibit it.

The photographs of the Silky Anteater on pages 44 and 45 were made at the laboratory of our Department of Tropical Research in Trinidad. On a Sunday morning some three years ago a very hot and perspiring East Indian trudged up the mountain road with a Silky in a box as a present for Dr. William Beebe. Since Staff Photographer Dunton was at the laboratory just then, Dr. Beebe accepted the animal and posed it on a limb in the yard. Eyes tight shut, it was apparently fast asleep, and I remember that Dr. Beebe lightly touched it once, to start it crawling. He jerked his hand away just in time; in a split second the "sleeping" animal slashed at him with its curved claws. Photography over, the Silky was carried up the mountain and released, and in a few minutes it was out of sight in a tall tree.

Some day, let us hope, a new genius may invent a modification of the standard anteater diet that will satisfy the Silky, and enable us to exhibit this smallest and prettiest of the anteaters.



ZOO PICTURE PAGES

PHOTOGRAPHS

BY

SAM DUNTON

An **EUROPEAN BEE-EATER** actually does eat bees — when it can get them. In the Zoological Park it makes out very well on the much less exotic mixture we give to most insectivorous birds. This colorful newcomer to the collection is found across Europe from Spain eastward into Asia. It nests in burrows which it digs in sandy banks, by preference, and is said to wear its beak down to half length by pecking at the soil. (The beak grows out again by the next season). It has a “rippling” call note.

It may not look like it, but this is actually a kind of Aquarium pre-view — for the two seals just getting ready to dive, and the one whose tail is just disappearing under the water, are animals that will eventually be exhibited at the new Aquarium at Coney Island. We are holding them at the Zoological Park until the Aquarium is ready. The newcomers, two **HARP SEALS** and one **ATLANTIC HARBOR SEAL**, came to us from the Atlantic Biological Station of the Fisheries Research Board of Canada.





Young Chimpanzees are quite capable of making up their own games and extracting entertainment from almost anything — but they have most fun when something novel and unexpected comes along. Keeper Quinn of the Great Apes House recently offered a long strip of burlap to our “Little Women,” **AMY, JO, BETH** and **MEG**, and the resulting tug-of-war and the frantic swinging as the strip was looped over a high bar in their compartment, kept visitors — and keepers — entranced for hours.





This is the first **HAWK OWL** we have had in our collection — a recent acquisition from the Edmonton Zoological Society in Canada. Unlike most owls, which do their hunting at dusk, the Hawk Owl is a day-flying bird, and its flight, though silent, is quite hawk-like.



It looks a little risky, but it isn't really. Head Keeper Spencook of the Reptile Department has occasion several times a week to enter a compartment containing three sizeable **INDIAN ROCK PYTHONS**. The biggest one, 15 feet long, is more or less indifferent to him, but the smaller ones are curious and "explore" him while he is busy scrubbing.

The Bird's Nest As a Dormitory

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

IN EQUATORIAL REGIONS where day and night are at all seasons approximately equal in length, the resident, diurnal birds spend almost half their lives in sleep, or at least resting quietly in their roosts. At higher latitudes in summer, the daily period of activity may be considerably longer than that of sleep. But if these birds remain in the same locality throughout the year, they will in winter have longer nights than days; the long winter nights compensate for the short summer nights; so that in this case, too, the birds spend about half their lives at their sleeping places. Migrants like the Bobolink and Golden Plover, which breed at high latitudes in one hemisphere and then pass the non-breeding season well across the equator in the other hemisphere, enjoy long summer days through much of the year and may devote a larger share of their lives to activity. But even in the continuous daylight of the arctic mid-summer, birds take a few hours of repose in each 24-hour period. All animals appear to require sleep, not excepting fishes, insects and other creatures which lack lids for closing their eyes.

Considering how much time they devote to sleep, it is surprising that so few birds take the trouble to prepare comfortable dormitories for themselves, as with their skill in nest-building many could do if so inclined. In wooded regions the majority of the birds roost amid the foliage. Many sleep singly, perhaps with their mate not far away, if, like so many tropical species, they remain in pairs throughout the year. Among the American flycatchers which live about my house in Costa Rica, the Tropical Kingbird, the Boat-billed Flycatcher, the Gray-capped Flycatcher and the Yellow-bellied Elaenia follow this method. I have sometimes found male and female roosting a yard or two apart, but never in contact.



Young, unmated flycatchers sometimes press close together in a row, perhaps with one of their parents, and make a charming sight as they go to roost on some slender twig in the evening twilight. I often find Blue Tanagers sleeping amidst the dense foliage of orange trees, male and female usually not far apart, but never in contact, and this, so far as I can learn, is usual in the tanager family. But the local finches and most other birds are more secretive, and I have rarely discovered just how they sleep.

Gregarious birds often congregate in great

numbers at their roosts. Those of starlings and crows are familiar to most people in northern lands, but that the American Robin also gathers in great companies for the night is not so well known. Recently an observer in the Transvaal estimated that one million European Swallows, on their way northward, passed the night in a single reed-bed, along with thousands of birds of other kinds.

Oceanic birds may sleep either on land or water. As the sun declines, long, sinuous strings of cormorants stream in to the barren islets off the coast of Perú, where in crowded thousands they pass the night on the guano-covered ground, to return next morning to their fishing far out in the

s nest of a Song Wren straddles the crotch of a sapling in a lowland forest. The doorway of the well-built structure is at the right, and five individuals came to it for lodging.

All photographs by the author

When these young Blue-throated Green Motmots left their burrow in a roadside bank, they roosted out in the cold rain but their parents continued to return to the underground nest each night.

Pacific. But petrels, albatrosses, auks and other birds which pass the non-breeding season hundreds of miles from the nearest land can hardly seek solid ground for their repose.

The majority of birds breed in open nests which offer few advantages as dormitories, while on the other hand they are liable to infestation by vermin, and they are probably easier for night-prowlers to find than a small bird perching amidst clustering foliage. Hence only in special circumstances do birds roost on open nests. In the deserts of northern México and neighboring parts of the United States, Palmer's Thrasher finds an open nest or platform an advantage when sleeping in a thorny cactus, whose crowded needles doubtless afford protection from four-footed predators. Rails, coots and other marsh birds build, in addition to their nests, sleeping platforms which raise them above the shallow water or sodden soil, and to these they lead their downy chicks to be brooded. Not long ago I found a compact platform, about a foot in diameter, situated head-high in the tangled vegetation beside a little marsh near our house. After nightfall I returned with a flashlight, which revealed a Wood Rail resting on it, staring into the beam with great red eyes. Neither then nor later did I find an egg on this bulky mass of vegetation, which was flatter and more exposed than the rail's breeding nests.



While certain thrashers and rails need something to separate them from a wet or a prickly substratum, with most birds protection from cold or rain is the chief attraction of a dormitory, hence only covered nests are used. Among birds which use dormitories are many wrens, a few American flycatchers, certain swallows, bush-tits, the Bananaquit and the Verdin, all of which sleep in structures they have built themselves. Many more go to rest in cavities of various sorts, either excavated by themselves, as with woodpeckers, barbets, kiwis and at least one kind of motmot, or found already prepared, as with swifts, toucans, woodhewers, certain swallows, titmice, a few wrens, a sunbird and others.

Did those birds which build dormitories, like wrens, or carve them out, like woodpeckers, begin by preparing these snug shelters for sleeping and then find that they also served for rearing their families; or did they first use them as breeding nests and then acquire the habit of sleeping in them even when not incubating eggs or brooding young? Over the years in Central America, I have little by little gathered evidence that the dormitory was, in most instances at least, originally a breeding nest, rather than the reverse.

In the great family of American flycatchers many species build covered nests, either oven-shaped or pensive, some of great beauty and others so bizarre that one would hardly take them to be birds' nests. Yet so far as I know, in only two related genera are these nests, all of which would seem to make safe, snug dormitories, used for sleeping. The first stage in the utilization of a breeding nest as a dormitory is represented by the Yellow-olive Flycatcher, a small, dull bird not uncommon in this valley. Its nest is a marvelous structure such as no northern bird builds. Shaped like a chemist's retort, with a globular body entered through a downwardly directed spout, it hangs from some slender vine or twig in a shady pasture or beside a roadway. The female alone builds this nest, which is matted or felted rather than woven like an oriole's pouch and is generally composed of blackish fibers. As with so many tropical birds, she begins to build long before she is ready to lay, and when her retort nears completion she sleeps in it, sometimes beginning a week before her first egg appears. She alone incubates the two or three eggs but receives some

help from her mate in feeding the nestlings. After these take wing they do not return to sleep in the nest, although their mother continues to do so. In this locality only a single brood is reared, and the female flycatcher may sleep in her nest for four months after the close of the nesting season. But even if not claimed by a bird of another species for its eggs, it gradually deteriorates in the wet weather, and I have found none in use as a dormitory after September. So the Yellow-olive Flycatcher, which seems never to build a nest especially for sleeping nor even to repair the one made in the first place for its eggs, appears to roost amid the foliage during the wettest and the coldest months of the year. Yet with a little industry it might enjoy a safe, snug shelter at all seasons.

The flycatchers of the genus *Rhynchocyclus* represent a somewhat more advanced stage in the use of dormitories. These slightly larger birds also build retort-shaped nests, but unlike those of the Yellow-olive Flycatcher they contain large dead leaves in their walls and are less neat in appearance. They usually hang in an open part of the woodland and are only exceptionally accessible for examination of their contents. I have never found more than a single grown bird sleeping in one, but they are occupied as dormitories at seasons which suggest that some are constructed for this special purpose.

AS AN EXAMPLE of the next stage in the evolution of the dormitory habit we may take the Bananaquit, a very small, yellow-breasted honeycreeper widespread in tropical America. In regions where it is abundant its little globular nests, made of pieces of dead leaf and other vegetation, are among the most frequently found of all birds' nests. Without using a small mirror, it is impossible to see the contents of the cozy chamber entered through a narrow, downwardly directed doorway. One may of course probe the interior with a finger; but this method must be used with caution, as sharp-toothed marmosas, ants and other biting creatures sometimes ensconce themselves within them.

The reason for the abundance of the Bananaquits' nests is that they are used by these prolific birds not only for rearing broods through much of the year but also for sleeping by both sexes at

all seasons. The breeding nest is built by male and female together, but she alone sleeps in it, not only while incubating the eggs and brooding the young but often before she lays and after her family has flown. The male, who helps the female to feed the nestlings, builds his own dormitory in the vicinity, usually without her assistance. Of the same shape as the breeding nest, it is often slighter and flimsier. Nevertheless I have seen some that were hardly to be distinguished from breeding nests, and in one instance a female claimed her mate's lodging for her eggs. Each adult sleeps alone, and one rainy evening I watched a male strenuously resist his mate's intrusion into his bedroom. The same nest may be occupied for months together, but whenever a Bananaquit loses its dormitory it promptly makes itself another, the male often singing squeakily as he works. Fledglings are never led back to sleep in the nest, where their mother may continue to pass her nights alone. After some nights in the open, a few of the youngsters manage to find unoccupied nests built by their own kind, or perhaps equally often a covered nest abandoned by a bird of another species. Before acquiring their brighter adult colors some of them undertake to build their own dormitories. One youngster who tried to construct a lodging for himself in the trees about our house had the product of his toil repeatedly taken from him by the adult on whose territory he intruded. The older bird then slept in the juvenile's nest.

The woodpeckers, which I take to be most primitive in their sleeping habits, are at the stage represented by the Bananaquit, and from this we can follow them to a more closely knit family life. In all that refers to sleeping, the Red-crowned Woodpeckers about our house resemble their neighbors the Bananaquits, with the difference that they carve holes in soft wood rather than build nests amid the foliage. With them as with other woodpeckers, the male is the more industrious wood-carver, with the result that he often has a better dormitory than his mate, who is sometimes content with a sadly dilapidated chamber. Hence it is natural that the female should deposit her eggs in his dormitory rather than her own, and that, continuing the use of his cavity by night, he should incubate them, while she sleeps elsewhere. By day the two

alternate in warming the eggs, as with other woodpeckers. After the month-old fledglings have left their nest, their father continues to lodge in it, while they pass the night clinging to a tree in the open. I have seen him actually repulse his children from his bedroom doorway, and evict them when they stole a march on him and entered first. But on a very rainy evening, a female youngster insisted so strongly on joining her father in the nest-hole in our garden that finally she had her way. But they slept together only a single night, after which he found another lodging and abandoned the old nest-hole to her. The Hairy Woodpecker closely resembles the Red-crowned Woodpecker in all its family arrangements. In these and a number of other woodpeckers, individuals past the nestling stage do not regularly sleep with other similar individuals at any season.

FROM the stage represented by these woodpeckers, two possible routes lead to more sociable sleeping in nests. The second parent might join the first in the dormitory, this continuing until their fledglings come to share it with them. Or one of the parents might lead the youngsters to a lodging at nightfall and stay with them, then by further evolution the second parent might join the family party. I am not familiar with any of the woodpeckers that exemplify either of these intermediate stages, for with them, so far as I can learn, either the grown birds sleep singly or all members of the family pass the night together. For the intermediate situation we must turn to other groups of birds. The motmots provide an example of the parents sleeping together, but not bringing their young to the dormitory. In the lovely, racquet-tailed Turquoise-browed Motmot of the warm lowlands, a single parent occupies the breeding nest by night, and after the young fly the burrow in the ground is deserted. But in the aberrant Blue-throated Green Motmot of the cool Guatemalan highlands, both parents sleep at the end of their long tunnel throughout the year, and they follow this practice while hatching their eggs and rearing their young. Although the latter emerge at a season when rains are long and cold, they do not return to share the snug chamber with their parents. These dig a new burrow soon after their single brood has fledged, and



here, if everything goes well, they will continue to lodge nightly until next year's brood has fouled the chamber, for motmots pay no attention to the sanitation of their nest.

The wrens show us the other intermediate stage, and from this we can follow them to still more companionable sleeping arrangements. The House Wrens of tropical America remain mated throughout the year; but male and female normally sleep apart at all seasons, in a hole in a tree, a niche in a bank, beneath the tiles of a roof, in the center of a bunch of bananas or in any other secluded nook they can find. The nest, placed in the same great variety of sites as are chosen for sleeping, is built by both sexes, but the female alone incubates and broods in it. The young are fed by both parents and after their departure they are led in the evening back to the nest or to some other sheltered cranny. Both parents show them to bed by going in and out of the chosen nook in their presence, continuing this until the weakly flying fledglings succeed in following. Their mother often sleeps with them, especially if they have been led back to the nest space, but she does not invariably do this. The father al-

most always goes to a separate lodging. If they continue to roost in the nest cavity, the youngsters are usually evicted before their mother's next brood hatches. Sometimes, however, they persist in sleeping with her despite parental opposition, and they may help to feed their younger brothers and sisters.

An advance on the House Wren's arrangements is shown by the Highland Wood Wren, which builds globular, moss-covered nests in the undergrowth of the cool, damp mountain forests. In these structures male and female sleep together at all seasons, except while the latter is attending eggs and nestlings, and sometimes her mate passes the night with her even then. For some weeks after they fledge, the one or two young lodge with both of their parents in a nest similar to that in which they were reared.

Banded Cactus Wrens differ from most members of their family not only in their extraordi-

A retort-shaped nest of the Yellow-olive Flycatcher. The doorway is in the spout hanging below the round bottom of the nest chamber.

narly large size but in their gregariousness, which seems to be caused by delayed breeding, the young staying with their parents and helping to feed their mother's next-year's brood rather than setting up housekeeping for themselves when a year old. Although the female seems usually to occupy the great globular breeding nest alone after the young have fledged, they, their parents and the helpers lodge in the same or a similar nest, continuing this custom throughout the year, usually with periodical changes of domicile. I have known eleven of these big wrens to sleep together. On mornings when frost whitens the open fields on their high mountains, they are most reluctant to venture forth into the cold, thin air.

The huge gatherings of Chimney Swifts in hollow trees or chimneys have been often described. In inclement weather many swallows, titmice, nuthatches or tree creepers may huddle together in whatever cavity they can find to keep them warm. Although European Wrens prefer at all seasons to sleep singly, in unusually cold, damp weather in England as many as forty-six may crowd into a bird-box. Despite the large

number of bedfellows, such aggregations cannot be regarded as representing the highest development of the dormitory habit, for they are temporary and promiscuous rather than based upon the family.

I believe that the highest development of the dormitory habit has been reached by certain tropical woodpeckers and barbets. In the Golden-naped Woodpecker and its relatives, as in the diminutive woodpeckers called piculets, male and female sleep in company throughout the year in a hole they have carved for themselves in a tree. By day they incubate alternately and at night both sleep with the eggs, the male, I surmise, actually covering them. In sharp contrast to wood-



As many as eleven birds have been found sleeping together in this bulky nest of the Banded Cactus Wren in frosty winter-time.

peckers like the Red-crowned and the Hairy, the fledgling Golden-napes and piculets, far from being repulsed from their parents' bedroom, are shown the way back to it, much in the manner of wrens. Young and old continue for months to share a common lodging. In the Golden-naped Woodpecker, which seems to be single-brooded, the young part company with their parents about

the time these move to a new hole for rearing the following year's brood. In the Olivaceous Piculet, which may rear two broods in a season, the youngsters of the first brood may continue to sleep with the parents while they hatch out their second set of eggs. In a nest which I watched this year, I was eager to learn whether the single surviving youngster of the first brood would help to feed the later brood with which it was so closely associated, but unhappily ants invaded the hole soon after the eggs hatched.

The sleeping habits of the Prong-billed Barbet of the Costa Rican highlands resemble those of the Golden-naped Woodpecker in every way, except that in the coldest and wettest months several families may lodge in the same cavity. Once I found sixteen sleeping in a small hole in a tree, where they must have been tightly packed. Woodpecker families, so far as I have seen, never club together in this fashion.

In the Golden-naped Woodpecker, Olivaceous Piculet, Prong-billed Barbet, Banded Cactus Wren and a few other birds, the nest, which originally served only to hold the eggs and helpless young, has through a long evolution become the family home, in which the parents and their full grown but still unmated children lodge together in comfort and safety throughout the year.

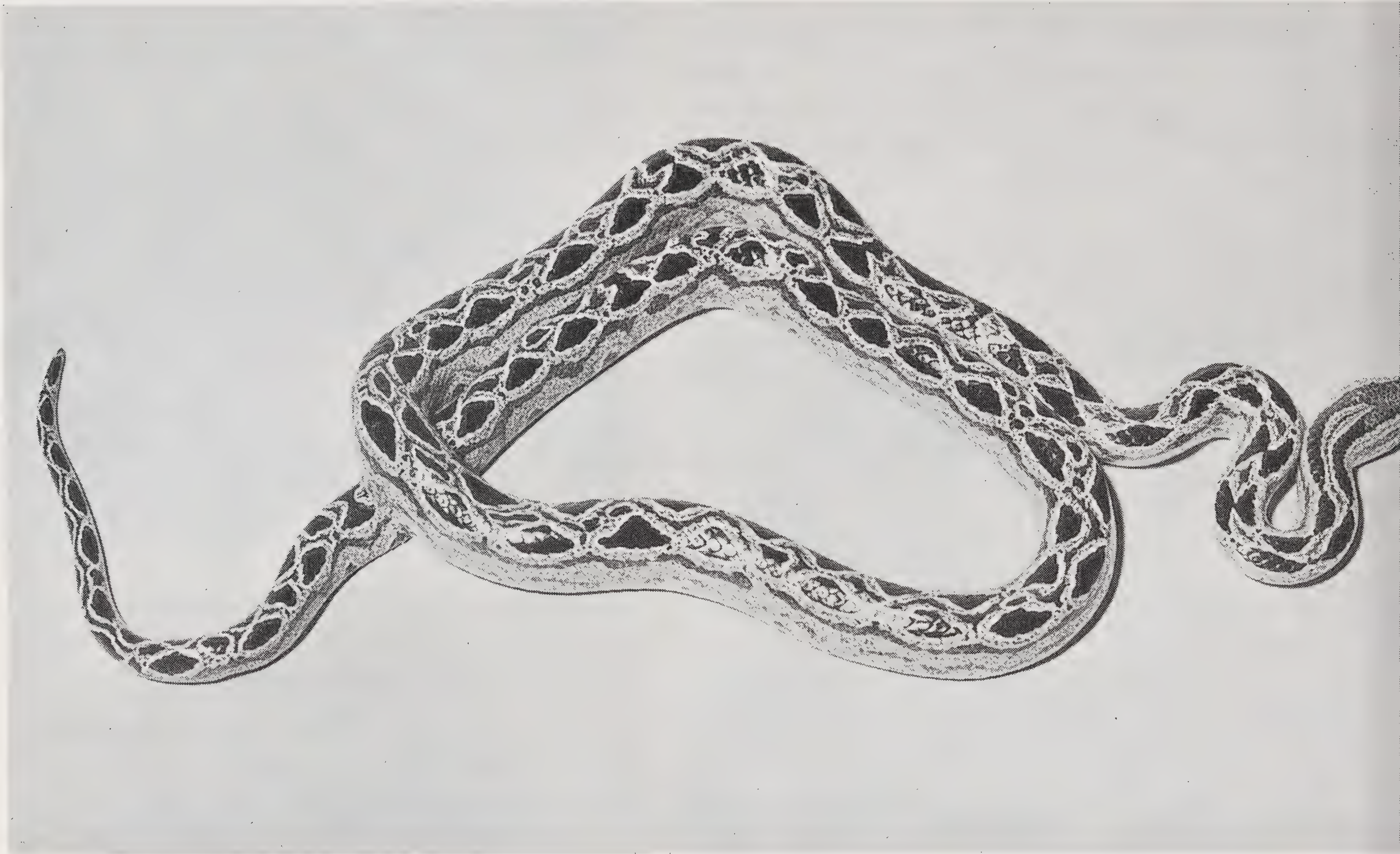
SCIENTIFIC NAMES OF SPECIES MENTIONED

Bobolink — *Dolichonyx oryzivorus*
Golden Plover — *Pluvialis dominica*
Tropical Kingbird — *Tyrannus melancholicus*
Boat-billed Flycatcher — *Megarhynchus pitangua*
Gray-capped Flycatcher — *Myiozetetes granadensis*
Yellow-bellied Elaenia — *Elaenia flavogaster*
Blue Tanager — *Thraupis episcopus*
American Robin — *Turdus migratorius*
European or Barn Swallow — *Hirundo rustica*
Kittiwake — *Rissa tridactyla*
Palmer's Thrasher — *Toxostoma curvirostre*
Wood Rail — *Aramides cajanea*
Bananaquit — *Coereba flaveola*
Verdin — *Auriparus flaviceps*
Yellow-olive Flycatcher — *Tolmomyias sulphurescens*
Red-crowned Woodpecker — *Centurus rubricapillus*
Hairy Woodpecker — *Dendrocopos villosus*
Turquoise-browed Motmot — *Eumomota superciliosa*
Blue-throated Green Motmot — *Aspatha gularis*
Tropical House Wren — *Troglodytes musculus*
Highland Wood Wren — *Henicorhina leucophrys*
Banded Cactus Wren — *Campylorhynchus zonatus*
Chimney Swift — *Chaetura pelagica*
European Wren — *Troglodytes troglodytes*
Golden-naped Woodpecker — *Tripsurus chrysauchen*
Olivaceous Piculet — *Picumnus olivaceus*
Prong-billed Barbet — *Semnornis frantzii*.

A Rare Gift:

The Guatemalan Boa

By JAMES A. OLIVER



THIS STORY might be considered a sequel to the article entitled "Banana Bonanza" in *ANIMAL KINGDOM* about a year ago. At least, the rare reptile forming the subject of this note came in to the United States in a banana shipment. But apart from sharing their original method of travel, the snakes discussed in the earlier article and the one described here took quite different routes to the Zoological Park. The tale of this little boa points a moral for all reptile curators: never turn down a donation without first looking at it.

Normally we operate on this basis whenever feasible. However, when Prof. Kimber C. Kuster offered to send us "a small boa or python" that had been received in bananas in Bloomsburg, Penn., it seemed highly probable that it would

The Curator of Reptiles declined politely when this snake was offered to us, thinking it was a common Boa Constrictor. It was sent anyway — and turned out to be the rare Guatemalan Boa.

be a small common Boa Constrictor. It would cost a minimum of \$2.50 to ship the specimen to us by railway express (live snakes are not accepted for shipment by mail). This would be several times the value of a small Boa Constrictor.

Thus I thanked Prof. Kuster for thinking of us, but felt obliged to decline his offer. I sent along a copy of "Banana Bonanza" so he could check the identification of his snake with our pictures. As far as I was concerned, the matter was closed — a simple routine correspondence that terminated like so many others.

Prof. Kuster was not able to identify his snake from the pictures. Fortunately he was not satisfied with an uncertain or doubtful identification and sent the snake to us. When the box arrived together with Kuster's letter, I probably muttered something uncharitable about the man's persistence in donating his snake to us after I had written we didn't want it. If any unkind thoughts entered my mind in the moment before the box was opened, they were quickly dispelled by outbursts of praise. The little snake was a beautifully marked, diminutive boa of a rare genus that occurs in the uplands of Guatemala southward to northwestern Colombia. Our specimen bears the scientific name *Ungaliophis continentalis*. It was described from Guatemala in 1880 by a German scientist, Fritz Muller.

Three species of these little boas have been described from widely separated parts of the generic range. The three are similar in characters and the variation suggests they may even be subspecies of a single species. However, they are so rare in collections that little is known about their true relationships, distribution or habits. In fact, it is not even known whether they normally live on the ground or in trees. We do know that our specimen has eaten small mice since it arrived in the Zoological Park. So far it has avoided the tree branch and spends most of its time under the moss on the floor of its cage. We hope we can learn more of the habits of this interesting and rare boa. Also, we are eagerly waiting to see what will turn up next in the way of a Banana Bonanza.

In a Way, the Lungfish Is a Missing Link

By JAMES W. ATZ

VISITORS WHO LINGER in front of the lungfish tanks in our Aquarium exhibit never fail to wonder at the ability of this fish to breathe air and live out of water. "The Curious Lungfish that Drowns in Water," proclaims the panel above the tanks, calling attention to the remarkable fact that this fish not only *can* breathe air but *must* do so. As the detailed label explains, the lungfish survives the droughts of its native Africa by sinking into the mud, forming a protective cocoon about its body and quietly aestivating until the rains come. Most amazing fact of all, the label concludes, these comatose fish have been known to live as long as four years without food or drink, but have promptly resumed a normal, active existence when returned to water.

Scientists as well as the public are impressed by the lungfish's curious ways. As a matter of fact, some of them have spent a good deal of time

and effort trying to understand the physiology of the fish. But there is another aspect of the lungfish's existence that interests scientists even more than its ability to live through protracted drought. This is the unique evolutionary position it occupies as a "living fossil" and "missing link."

These expressions are in bad odor with zoologists. After all, a "living fossil" is a contradiction in terms, and to what chain belongs the "missing link"? But the terms do suggest if not define the facts. Technically a living fossil would be a creature alive today, the fossilized remains of whose kind can also be found in ancient rocks. Actually there is no such animal in existence — a living species *identical* with a fossil — and that is why zoologists have logic on their side in their aversion to the term. But there *were* lungfishes on earth about three hundred million years ago so similar in appearance to ones swimming about



This baby Lungfish is 2¾ inches long and its gills (visible behind the slender forward pair of fins) have already begun to be resorbed.

Even though it still has external gills, gulps of air are necessary to the baby. Here it is rising to the surface for a swallow of air.

today that even a nonzoologist would be impressed by the resemblance. Lungfishes have been around for a long time, and have changed but little during those millions of years. As scientists put it, their rate of evolution has been extremely slow; they are a conservative group.

The expression "missing link" needs no explanation to those who lived through the days of the Scopes "Monkey Trial" in Tennessee. The Missing Link was supposed to be the skeleton in everyone's hereditary closet, the brutish creature, half man half ape, that linked our family tree to the Gorilla's. Well, even though today no one takes seriously so crudely simple a view of man's evolution, the concept of the missing link as something in between, something in the process of evolving from one kind of animal to another, is a helpful one. *Archaeopteryx* is perhaps the best example we have of such a transitional form. It had wings and feathers like a bird, but possessed teeth, claws on its wings and a long, fleshy tail like a reptile. *Archaeopteryx* lived a hundred



and fifty million years ago, and all we know about it has come from the study of the fossil remains of only two individuals. The lungfish may not be as striking a missing link, but it has one tremendous advantage: it is extant, and scientists can study it in ways they can study no fossil.

The lungfish is just about as much amphibian as fish. In this respect it harks back to those times three hundred million years ago when backboned creatures first attempted to leave their ancestral home in the water and invade a new element; that is, when the fishes first started to come out on land. Merely looking at the lungfishes on exhibition at the Aquarium would lead few of us to guess their amphibian relationship, however. Unusual fish that they are, they certainly appear more fish-like than frog-like, or salamander-like. It is only when one examines

the arrangement of their vital organs or looks at their cells under a microscope, that a closer similarity to conditions found in a frog than in any other fish is revealed. So, too, a study of the egg of the lungfish would show that it develops the way a frog's egg does, in a manner vastly different from all other fish eggs. As a matter of fact, some biologists have classified the lungfishes with the salamanders, frogs and toads, rather than with the salmon, bass and all their piscine relatives. That biologists themselves cannot agree just where the lungfishes belong in the classificatory scheme of things provides a good indication of the intermediate position they occupy.

Last autumn the Aquarium received three small African lungfish that graphically demonstrated their close affinity to the amphibians. In all respects save one they appeared like miniatures of the adults we regularly exhibit. Projecting from either side of the head were three feathery gills. Such external gills are found on but one other kind of fish (the Lobefin, *Polypterus*) — and here, too, only on young individuals. On the other hand, external gills are common among the larvae of salamanders and are present on both young and adults of a few other species of amphibians such as the Mudpuppy and Siren of North America and the blind Olm from caves in central Europe.

Ever since 1900, when John Samuel Budgett,



The Axolotl is one of the salamanders that has external gills which it keeps throughout life. Take away the legs — or, rather, change them into slender fins — and the creature would have much the appearance of a baby Lungfish. Internally, the resemblance is even more striking.

the intrepid British zoologist, found his first lungfish nest in a fever-ridden Gambia swamp, it has been known that baby African lungfish possess external gills. During the rains the adult lungfish, probably the male, digs a tunnel or hole in the clay bottom or bank and deep inside the rough, water-filled nest the female lays her several hundred eggs. This completes her obligations to the next generation, but the male's parental duties have only just begun. For a week he guards the developing eggs, viciously attacking all intruders — including any human hand whose owner is so foolish as to risk the fish's mangling bites. During this period the male spends a good deal of the time at the entrance to his aquatic burrow, circulating water around the eggs by means of movements of his tail. After the eggs have hatched, the father fish continues to guard his brood.

When the young lungfish hatches out, it is already provided with four pairs of gills. While absorbing the remainder of its yolk, each larva attaches itself, head up, to the walls of the nest, its gills outstretched as if to utilize every bit of oxygen present in the warm and frequently rather stagnant water. At the age of about one month, the young lungfish leaves the nest to take up life on its own. At this time it is not quite an inch and a half long and has lost one of its pairs of gills. Although the other three sets are still well developed, the youngster has already started to make use of its lung and regularly comes to the surface to take a tiny gulp of air. For the rest of its life it will be as dependent on atmospheric air to sustain its life as any four-footed animal that spends its whole existence on land. Gradually the external gills disappear, but in at least one of the four African species vestiges of them can remain until the fish is nearly two feet long. In our specimens, gill resorption is proceeding quite rapidly. Since we purchased them, they have grown to a length of about 5 inches and have lost a second pair of gills.

Like most frogs and salamanders, the lungfish starts out as gill-breathing creature able to use the indispensable oxygen that is dissolved in water, and like most of the amphibians, it ends up as an air-breathing animal with a lung that can utilize oxygen only in its gaseous, atmospheric state.

Saturday Morning Zoo Tours for Members

WHY WE DIDN'T think of this a long time ago, we don't know. At any rate, we *have* had the bright idea, and here it is: each Saturday morning from 11 o'clock until noon, starting immediately, one of the Zoo's Curators will be available and happy to take Members and their children on little tours of the Zoo.

He'll know, of course, what's newest and most interesting — the best time to see the baby Otters, whether the Birds of Paradise are still displaying, and so on. It should make your visit more enjoyable to have a well-informed guide (he'll want

particularly to show you *his* animals) and the Curators themselves are looking forward to these pre-lunch strolls in pleasant company.

The rules are few and simple. You don't have to make reservations — just show up at the Members' Lounge in the Administration building at 11 A.M. any Saturday. Whichever staff officer happens to be on duty at the time will introduce himself, and away you go. It's a *walking* tour — no tractor train rides. These conducted tours are strictly for *Members of the Zoological Society and their children*. No guests — it'd get out of hand.

New Members of the New York Zoological Society

(Between January 1 and February 29, 1956)

Benefactor

DeForest Grant

Founder

George F. Baker
Miss Anne Phipps

Patron

Mrs. Mabel S. Ingalls
John Eugene Phipps
Mrs. Magda Merck Sheldon

Life

John S. Griswold

Contributing

Francis R. Appleton, Jr.
Charles F. Ayer
Melbourne Bergerman
Mrs. Henry J. Bernheim
Miss Susan Dwight Bliss
Mrs. Hugh Bullock
Mrs. Blair Clark
Mrs. LeRoy Clark
John F. Cohane
Morris Cohen
Jay N. Darling
Miss Carolyn Davey
George T. Delacorte, Jr.
Mrs. Charles D. Dickey
Mrs. Oliver D. Filley
Mrs. W. French Githens
James L. Goodwin

William J. Griffin, Jr.
Mrs. John H. Hall
Brigadier John H. Hardy
Duncan G. Harris
Newbold L. Herrick
Miss Ruth W. Jones
Robert W. Kean
Irving B. Kingsford
Mrs. Warren Kinney
Albert Robert Kraemer
Dr. David M. Levy
Mrs. William A. Lincoln
Mrs. Edgar Mayer
Hubert McDonnell
Harold C. McNulty
R. J. Mechin
Gerard L. Moench
Malcolm Muir
Joseph G. Myerson
Mrs. Gordon S. Rentschler
Alexander F. Robb
Ellison Ward Smith
Mrs. Robert D. Sterling
Miss G. Marietta Stewart
Mrs. Robert R. Titus
Mrs. Gene Tunney
Edwin Wile
Mrs. Louis J. Woolf

Annual

Mrs. Archibald Barrow
Mrs. B. G. Bedichek

Miss Martha Bein
Roger W. Berry
Mrs. Donald C. Brace
Mrs. Joseph Conklin
Miss Katharine P. Cortesi
Dr. Ralph M. Crowley
Frederic H. Cruger
H. C. Dienst, Jr.
Miss Dorcas Farquhar
Miss Karen Farquhar
Mrs. Joseph Feibush
Marshall Field, III
Mrs. Shirley C. Fisk
William B. Forman, Jr.
Alexander Frank
Mrs. Henry Clay Frick
Mrs. Dermot W. Gale
William H. Gehrman
John D. Gordon
Phillip Gray
Bernard Gross
Mrs. Philip Hamburger
Miss Mary E. Herr
Raymond P. Holden
Mrs. Archibald M. Holding
Miss Mollie-Jane Isaacson
Mrs. Mildred T. Kennedy
Dr. Karl Kranz
Leo A. Leonard
Mrs. R. E. L. Lewis, Jr.
Barry M. Martin
Gunnar Maske

Mrs. Benjamin Moore
G. H. O'Sullivan
Robert Palazzo
Miss Alice Parmelee

Miss Elizabeth Gay Pierce
Miss Henrietta F. Rothblatt
Morton Silberman
Mrs. William Strubing

Gerald B. Swart
Thomas Thacher
Mrs. J. R. Thiem
Thomas Forster Wardle

News from the Conservation Foundation

Looking to the Future

Regional planning is a first-rate way of attacking conservation problems. It is a method of assessing resources at hand against current and future community needs.

This approach is being tried in the watershed community around Princeton, New Jersey, under the leadership of the Stony Brook-Millstone Watersheds Association, established in 1950, with Trustee David McAlpin as one of the founders.

The problems which the Princeton region faces are typical of those in many once-fertile areas in the East now invaded by suburban growth. Reserving adequate recreation areas for growing communities of the watershed is one of the pressing needs. Others are traffic planning, industrial and residential development, water supply and control — all of which can best be dealt with on a regional basis. The first step is mapping of present uses of land in the watershed. From this and a forecast of trends, the communities concerned may choose the future pattern of growth to make the best use of the resources still available.

Rutgers University Planning Department is providing technical leadership. It is our belief that success in the Princeton effort will encourage more regions to adopt this grass-roots planning approach for their watershed areas.

Resource Training Opportunities

In connection with our study of resource training at the graduate level, the Conservation Foundation is sponsoring a conference on graduate resource training and employment needs at the School of Natural Resources, University of Michigan, on April 27 and 28. The object of the meeting is to bring together a carefully selected group of representatives from universities giving this kind of training, and representatives from busi-

ness, industry and government. It is hoped that discussion will emphasize the value of such training, reveal specific areas within business, industry and the professions that need personnel trained in resource management, and help universities to develop programs to meet employment opportunities.

Royalties Rising

Royalties from published research reports and from our educational films are slowly but steadily rising each year. For 1954 and 1955 we received \$6,357 in royalties from publishers and \$19,432 from film sales. However, a substantial part of these receipts have to be paid over to authors or sponsors of the various projects. For example, 50% of the receipts from sales of *The Flood Control Controversy* are paid to the authors, and the major part of the royalties received from educational films is being repaid to the New York Zoological Society to reimburse it for the original financing. Nevertheless, the upward trend of revenues from these sources is encouraging.

Radio Program

It is hoped that the readers of ANIMAL KINGDOM are listening to the current weekly broadcasts of our Conservation radio program, *Today and Tomorrow*. The last of the series will be broadcast on May 20. Mr. James Cagney, the actor, who has long been concerned by conservation problems, has volunteered his services as narrator. Mr. Bernard M. Baruch has recorded the theme which is expressed at the opening of each program. In New York City the program is heard Sunday nights at 6:35 over WRCA.

An adult discussion guide entitled *Concepts of Conservation* has been prepared for general distribution. Copies are available at twenty-five cents each from the Conservation Foundation.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Komodo Monitors Getting a New "Apartment"

Within the next few days our two Komodo Monitors will again be on exhibition in the Reptile House — definitely by the end of the first week of April — after having been in seclusion since mid-January. Their roomy compartment at the east end of the building has been completely remodelled.

Soon after they arrived last spring it became apparent that they needed better accommodations than we could give them in the old Galapagos Tortoise quarters. They needed heated floors, for one thing, and while heating pipes were being installed we went ahead and redecorated the whole room. In the meantime, the two giant lizards have been living in the fenced-off public space at the end of the building.

It has been possible to give them warm water in a large, shallow tank while they were in temporary quarters, and they loved it. Both monitors spend a good part of the day in the water, and their appetites have improved enormously. Their tails are thicker and fatter than they were when they came and the female has put on an extra 1½ inches in length; she is now 8 feet 5½ inches. The male is still 8 feet 9 inches, but is obviously heavier.

With warm floors, warm water in their pool and a wooden ledge on which to bask while an overhead heater pours warm air on them, we think they will continue to thrive in their modernized quarters. — W.Br.

Congolese Rarities Come to the Aquarium

Although the fish fauna of the Congo is surpassed in richness only by that of the Amazon, the number of Amazonian fishes imported into the United States has always exceeded Congolese ones at least a thousandfold, and probably more.

One of the principal reasons for this difference has been the difficulty of transporting live fish from Africa. Until quite recently there were no direct flights from the Congo to North America available to fish collectors. Now there is a plane that makes a non-stop trip from New York to the Belgian Congo, and back non-stop, once a week, and on its western flight it usually carries a number of boxes of small freshwater fishes.

Our collections have already benefitted considerably from this arrangement, ten species never before exhibited by us having been acquired from the dealers responsible for the shipments. The two species of characin belonging to the genus *Distichodus* and the two catfishes, *Synodontis angelicus* and *S. acanthomonias*, are noteworthy for their color patterns that make them among the most attractive of freshwater fishes. More unusual than handsome are *Ctenopoma acutirostris*, one of the climbing perches, and *Phractolaemus ansorgi*, a primitive fish so strange that it occupies a family all by itself, as well as a species of *Phago* and *Polypterus*, both of which are new to us.

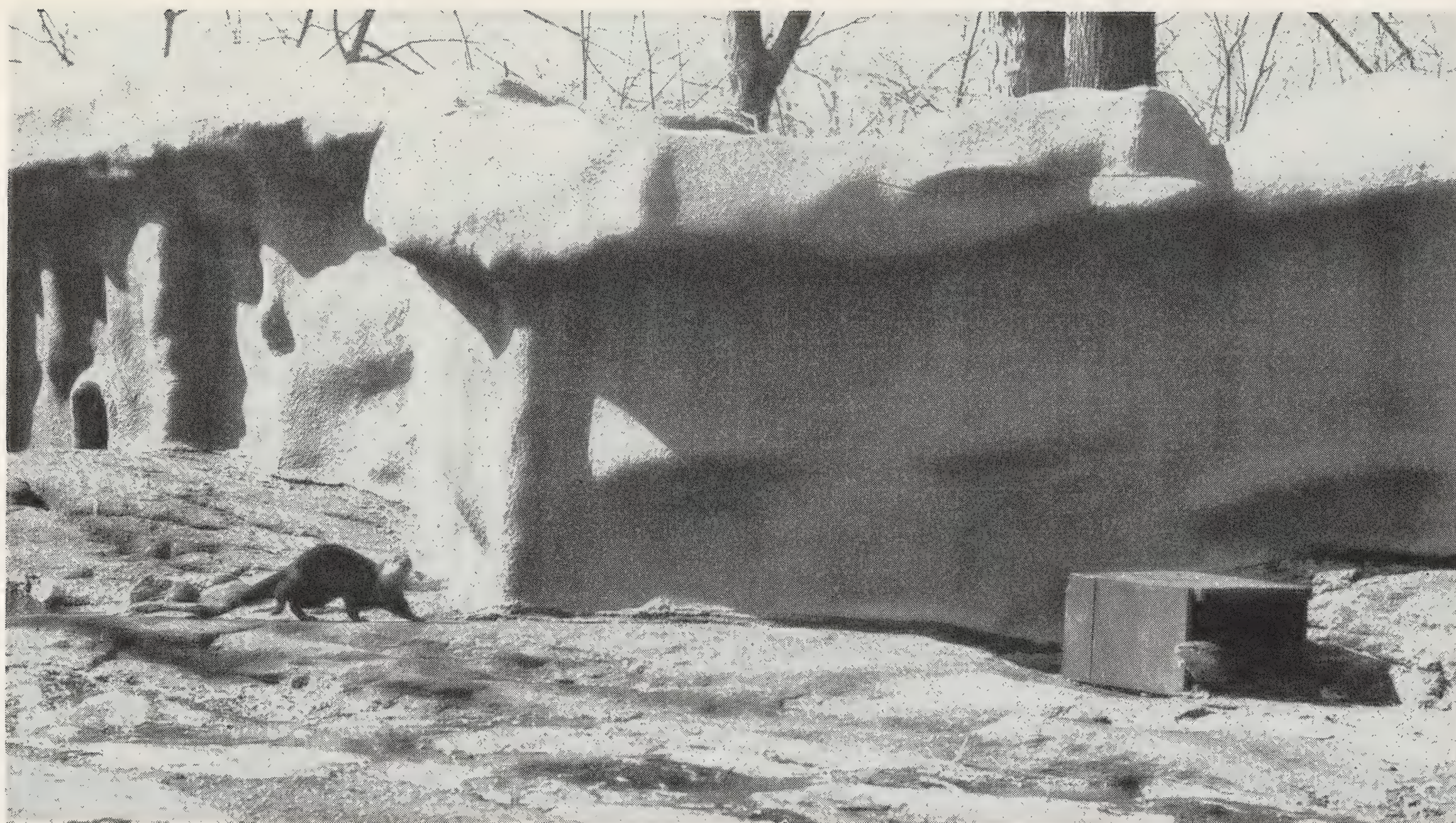
A fitting climax to this succession of rarities was the acquisition of four species of mormyrids, two of them new to us. One of these belongs to a species of elephant fish whose peculiar, down-curved snouts still excite incredulity even though they have been well-known since the time of the ancient Egyptians. — J.W.A.

The Annual Census

The census of the animal collections, made on December 31, 1955, has now been reported by the various departments. It shows:

	Species	Specimens
Mammals	186	543
Birds	572	1,457
Reptiles	234	653
Total	992	2,653

With nearly a thousand kinds of animals, the



The four Florida Otters born on January 5 have begun to make daily excursions out of the den (its entrance can be seen at the left, in the wall around their enclosure) in company with their mother. On their first emergence some weeks ago, the male showed immediate interest but was chased away by the outraged female. He has since taken shelter in a small box we provided some thirty feet from the den, and when the babies come out for their daily airing he looks around the corner of the box but does not attempt to join his offspring.



New York Zoological Park's is by a considerable number the largest zoological collection in the United States, a position it has held for many years.

Spring Openings

Easter week-end is traditionally the beginning of the spring season in the Zoological Park, although when Easter comes as early as it does this year many of the tropical animals are kept indoors for another three or four weeks. The Children's Zoo opening date is March 31 and the Farm-in-the-Zoo will open on Saturday, April 14. Tractor trains were scheduled to start running on March 29, and all restaurants to reopen by Easter, weather permitting.

IN BRIEF

Hooded Vultures. Two very fine Hooded Vultures are now on exhibition in the north cage of the Eagle Aviaries. Our last Hooded Vulture, which died in 1944, was presented by Roy Chapman Andrews.

Busy Place, the Zoo. Hammers, saws and dredging machinery are going to be prominent parts of the Bronx Zoo landscape this spring and summer. The old Primate House, closed to the public and used merely as a storage space for part of the monkey collection for several years, is now in process of getting a new floor, new roof and

new compartments for the animals; it is hoped to reopen it next fall. The Lion House, too, is getting new floors in the twelve compartments. Work on modernization of the south section of the Bear Dens should start this spring, and the Wildfowl Pond has been drained, mud will be scooped out of its concrete basin, and a confining wall built around it. The pond will be somewhat smaller when the work is finished, but we hope that the deeper and cleaner water will prevent the outbreaks of botulism that have plagued the pond for many summers. Finally, the Heads & Horns Museum is in for a thorough housecleaning and rearrangement of its trophies, many of them world's records.

"About the Bronx Zoo." If any of our Members would like to have a small folder giving all sorts of information about the Zoo (opening and closing hours, feeding times, directions how to reach the Zoo by automobile and subway, and the like), a copy can be obtained from the Membership Department by phoning the Zoo, Wellington 3-1500.

PUBLICATIONS OF INTEREST

AN AUSTRALIAN ANIMAL BOOK. By Charles Barrett. One hundred illus. from photographs in black and white. Oxford University Press, Melbourne and Wellington, 1955. 27s. 6d.

The original edition of this useful book filled a noticeable gap in publications on the fauna of Australia, so that this revised and re-set issue is very welcome. Mr. Barrett, well known to members of the Zoological Society through his numerous contributions to our publications, is an experienced field naturalist, and much of the information offered was gathered at first hand. Mammals, birds, reptiles and fishes are covered as extensively as could be expected in the space of a single volume. A closing chapter devoted to the status of introduced mammals and birds is of special interest. — L.S.C.

A BIBLIOGRAPHY OF REFERENCES TO DISEASES IN WILD MAMMALS AND BIRDS. Compiled by Patricia O'Connor Halloran. 465 pp. Published as Part 2 of the American Journal of Veterinary Research, Vol. XVI, No. 61, October, 1955. \$10.

Any of our Members who are concerned with the keeping of wild animals will be interested to know that a bibliography of thousands of references to the diseases of mammals and birds has been published. It was compiled by Dr. O'Connor, veterinarian of our sister institution, the Staten Island Zoo, and attempts to cover the literature of the past 120 years. It is not exhaustive, but it is a valuable beginning and foundation, a most useful tool for the specialist. — L.J.G.

NORTH AMERICAN BIRDS OF PREY. By Alexander Sprunt, Jr. Foreword by Roger Tory Peterson. Illus. by 46 plates in color, by Allan Brooks and others, also four plates of silhouettes by Roger Tory Peterson. Pub. under the sponsorship of the National Audubon Society, by Harper & Bros., New York, 1955. \$5.

Based on John B. May's book of the same title, published nearly twenty years ago and now out of print, the present volume brings up to date information concerning life histories and economic status of our Vultures, Hawks, Eagles and Owls. Throughout, Dr. Sprunt pleads earnestly and well for greater protection for this much maligned group, the economic and esthetic values of which have been too long misunderstood. The colored plates, mostly made from paintings by Allan Brooks, but with Louis Agassiz Fuertes and Walter A. Weber also represented, are excellently printed. — L.S.C.

HOW TO CATCH SALT WATER FISH. By Bill Wisner. 247 pp., numerous illustrations of fish and rigs by Jon Gnagy and Glasier Crandall. Essy Publishing Co., Roosevelt, L. I., N. Y. Paper edition, \$2.00; hard covers, \$3.00.

Bill Wisner, editor of the popular and practical magazine "Fishing Long Island Waters," is a man who knows salt water fish and fishing about as thoroughly as it is humanly possible to master such a complex field. Lightly, anecdotally, and yet soundly, he passes on a lot of valuable information in his new book. — R.F.N.

OUTDOOR HAZARDS REAL AND FANCIED. By Mary V. Hood. xiv + 242 pp., numerous illustrations by Don Perceval. The Macmillan Co., New York, 1955. \$3.95.

For no particularly good reason, many persons, especially males, tend to think of the outdoors as one of the few remaining strongholds of masculinity. That this notion is fallacious, if any proof is really necessary, is shown by this excellent book, written by a woman. Mary V. Hood has spent many happy and interesting days in the outdoors, mainly in California. Thus she writes knowingly and with much practical experience of the hazards that may be encountered in the outdoors. While her emphasis is principally on the hazards to be found in the western United States, her book should be owned and read by anyone planning to spend much time out-of-doors. — J.A.O.

BATS. Written and illustrated by Charles L. Ripper. 64 pp. William Morrow & Co., New York, 1954. \$2.00.

Most people know very little about bats, the only true fliers among the mammals, and what knowledge they do have about them is often erroneous. Written for children, this introductory book about these strange and interesting furred fliers is therefore most welcome. The simple factual text tells a great many interesting things about bats: how they live, fly, obtain their food, hibernate and reproduce. The chief charm of the book, however, lies in the attractive black and white illustrations with which it is profusely illustrated. — R.M.McC.

PAWS, HOOFS AND FLIPPERS. By Olive L. Earle. Illustrated by the author. 192 pp. William Morrow & Co., New York, 1954. \$3.50.

Miss Earle, who previously has written, among others, two extremely useful and introductory nature books, "State Birds & Flowers" and "Birds and Their Nests," has come up with a third fine volume — this time a survey of the mammals. The author has chosen to group the mammals according to whether they have claws, hoofs, flippers or nails. This is an interesting and convenient way to show broad relationships, and to explain how each mammal's feet are adapted for its particular way of life. Under each category, the mammals are discussed order by order, with some examples in each group portrayed at length. — R.M.McC.

HERE'S THAT PAN AGAIN



YOU ARE CORDIALLY INVITED

As a member of this Society, to take part in a pagan salute to Spring—any time now—at the New York Zoological Park, Bronx Zoo. So fling off that winter garment of repentance and send us the names of some worthy wights who should be members of our fellowship. Card bound into this magazine for this express purpose.

MEMBERSHIP COMMITTEE,
New York Zoological Society



ANIMAL KINGDOM



NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT	VICE-PRESIDENTS	SECRETARY	TREASURER
Fairfield Osborn	Alfred Ely Laurance S. Rockefeller	Harold J. O'Connell	David H. McAlpin

EXECUTIVE COMMITTEE

Laurance S. Rockefeller <i>Chairman</i>	<i>Class of 1956</i>
George F. Baker, Jr.	Archibald S. Alexander
John Elliott	A. Raymond Dochez
Alfred Ely	Robert G. Goelet
Robert G. Goelet	De Forest Grant
De Forest Grant	Eugene Holman
David H. McAlpin	Warren Kinney
Robert Moses	William De Forest Manice
Harold J. O'Connell	Harold J. O'Connell
Fairfield Osborn	Landon K. Thorne
Edwin S. Webster, Jr.	J. Watson Webb

BOARD OF TRUSTEES

<i>Class of 1957</i>	<i>Class of 1958</i>
Robert E. Blum	George F. Baker, Jr.
Percy Chubb, 2nd	F. Trubee Davison
C. Suydam Cutting	John Elliott
Alfred Ely	Robert I. Gannon
Marshall Field	Peter Grimm
Childs Frick	Fairfield Osborn
Henry Clay Frick	Eben Pyne
David H. McAlpin	Laurance S. Rockefeller
Richard C. Patterson, Jr.	John M. Schiff
John H. Phipps	Henry Sears
Alfred G. Vanderbilt	Edwin S. Webster, Jr.

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Richard H. Manville *Curator, Mammals*
Grace Davall *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandal *Associate Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch *Assistant Curator, Education*
Quentin Melling Schubert *Superintendent,*
Construction and Maintenance
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. *Research Associate in Ichthyology*
Harry A. Charipper *Research Associate in Histology*
Homer W. Smith *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez Caryl P. Haskins
Alfred E. Emerson K. S. Lashley
W. A. Hagan John S. Nicholas

AFFILIATES

C. R. Carpenter, *Co-ordinator*
Animal Behavior Research Programs
L. Floyd Clarke, *Curator*
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen Hugh J. Ross
George E. Brewer, Jr. Robert G. Snider
John C. Gibbs Peter M. Stern
Samuel H. Ordway, Jr.

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

Bessie—Our Indian Rhinoceros
Sam Dunton Cover

Nature's Skyscrapers
George G. Goodwin 66

Platyfish Come from
Strange Places
Myron Gordon 74

Hortense Has No Tail
to Tell *James A. Oliver* 77

Springtime in the Zoo
Photos by Sam Dunton 80

Report on the Aquarium
William Bridges 84

The Dance of the
Manakins *D. W. Snow* 86

Behind the Scenes 91

Vol. LIX JUNE No. 3
1956

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

"The Sea Around Us"

THE NOTABLE SUCCESS of Rachel Carson's book, of the above title, was no accident. As will be recalled, it was at the top of the best-seller list in this country month after month, and travelled throughout the world, being published in twenty-four foreign languages. Incidentally, our Society was privileged to present our Gold Medal to Miss Carson four years ago in recognition of her accomplishment in interpreting the life of the oceans. The fascination that people found in reading her book represents just one more proof of the profound interest people everywhere have in the life and mysteries of the sea.

We think back, too, upon the potent magnetism of the old Aquarium at the Battery which, antiquated as it was, drew more than two million visitors a year. With these thoughts in mind we confidently expect that the new Aquarium will meet with widespread public interest and acclaim. After long years of planning, the first unit of this great new institution is about to come into existence. Construction is now completed and forthcoming months will be ones of great activity preparing the "show" for public opening in the Spring of next year.

It must be realized that this first unit represents but the first portion of an institution which one day we must bring to reality. Our hope is that this first element of the ultimate future Aquarium will prove so successful that it will attract the funds required to complete the entire project.

The plans envisage an institution of incomparable beauty and scope. The Bronx Zoo, which our Society has so successfully managed and developed, brings to millions of people an opportunity to view and study rich and varied collections of animals living on the land. Now we must complete the circle of our purposes and destiny and bring to the public the opportunity of enjoying and learning about the living creatures of the "world of waters."

Fairfield Osborn

JUN 20 1956

Nature's Skyscrapers

By GEORGE G. GOODWIN

*Associate Curator, Department of Mammals,
American Museum of Natural History*

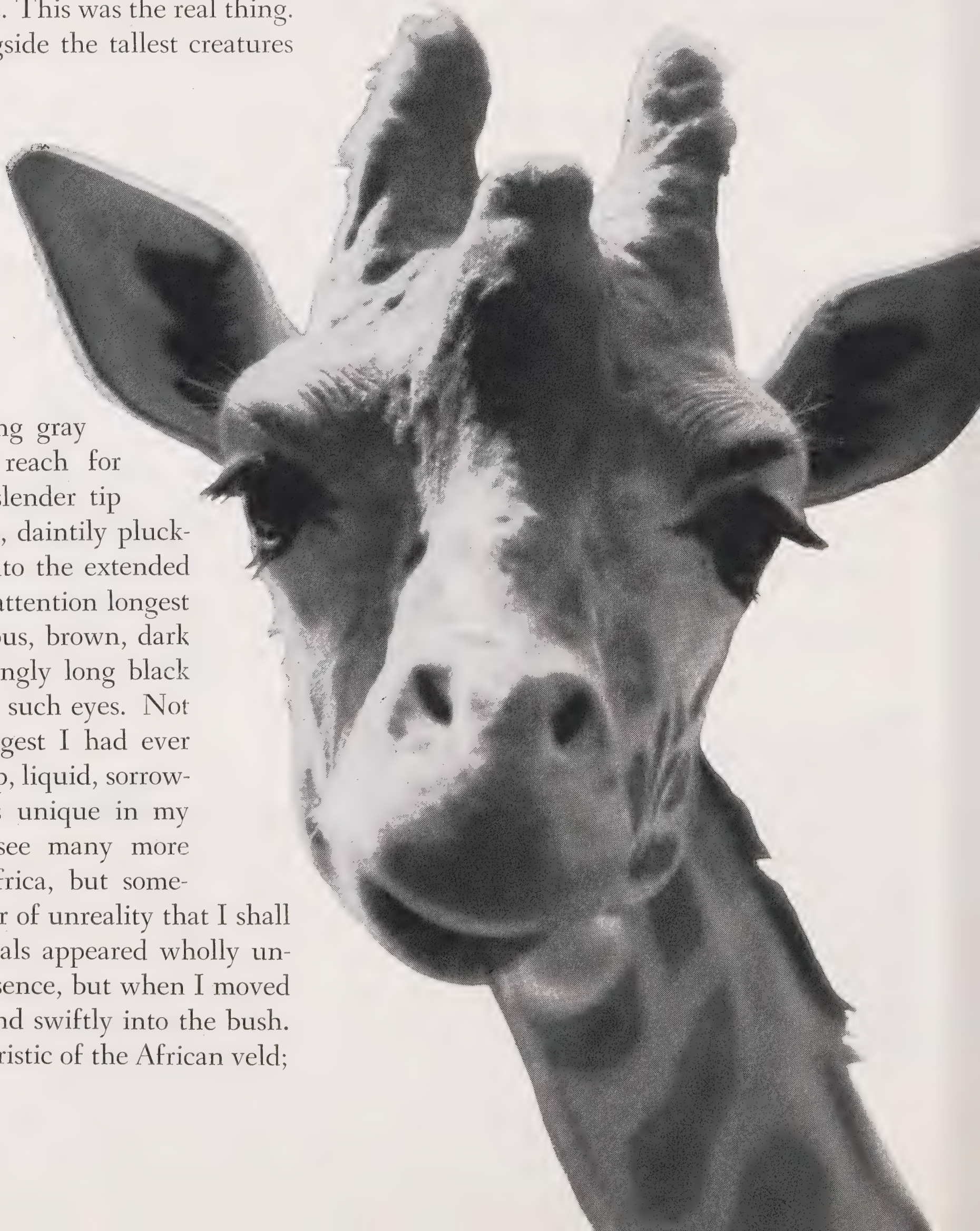
IT WAS ALONG A TRAIL leading east from Voi in Kenya Colony, British East Africa, that I first got acquainted with the giraffe. Four big fellows were browsing leisurely on the top-most branches of an acacia tree. I had seen giraffes before in zoos and museums and even from the train on my way from Mombasa to Nairobi, but this was different. There were no iron bars or plate-glass windows here. This was the real thing. I was a little man alongside the tallest creatures on earth.

Only the heads of these giants could be seen, rising a foot or more above the flat-crowned tops of the trees, green with feathery foliage. I was so close that I could see the long gray tongues dart out and reach for leaves and shoots, the slender tip wrapping around a twig, daintily plucking it and drawing it into the extended lips. But what held my attention longest was the giraffes' enormous, brown, dark eyes, shaded by surprisingly long black lashes. I had never seen such eyes. Not only were they the biggest I had ever seen, but they had a deep, liquid, sorrowful expression that was unique in my experience. I was to see many more giraffes before I left Africa, but somehow this scene had an air of unreality that I shall never forget. The animals appeared wholly unconcerned about my presence, but when I moved they vanished silently and swiftly into the bush.

The giraffe is characteristic of the African veld;

more so than any other creature. Nowhere else in the world is there an animal remotely like it. Its only living relative is the Okapi — an example of the giraffe's primitive ancestors — and they have no close allies. The nearest relationship seems to be with the deer, but only in a remote sense.

Not only is a giraffe the tallest animal, but it





is among the four largest land animals. Full grown bulls are often 19 feet high and some are even taller. A large portion of the height is obviously accounted for by the long neck, in which the seven vertebrae (the same number as in man and other mammals) are greatly elongated. A shoulder height of 12 feet is not unusual. A man can even stand upright between the front legs of a bull giraffe. The animal's back slopes sharply backward from the shoulders, not because the front legs are longer than the hind, for both are about the same length, but because of the extra long shoulder blades and the greater depth of the body in front.

Most large bull giraffes weigh a ton to a ton and a half, but estimated weights go up to as much as two tons. Cows are two or three feet shorter than the bulls and weigh between 1,100 and 1,200 pounds.

The giraffe's lips are long, prehensile and quite hairy — a protection against the stabbing thorns of its favorite food tree, the acacia. The upper lip extends well in advance of the lower and the extensible tongue, up to eighteen inches long, is a marvellously adept tool for plucking leaves and twigs. The giraffe probably has the best sight of any African big game animal, and its height gives it the greatest range of vision of

The great plains of Africa, dotted with "orchards" of flat-topped acacia trees on which the animals feed, are the home of the twelve kinds of giraffe. Running, as here, they have been clocked at 32 mph.

Photo from British Information Services

any earth-bound creature. Its sense of smell is keenly developed, too.

The characteristic pair of horns on top of a giraffe's head are short, bony structures covered with hairy skin. In very early life these develop separately from the skull but eventually become attached to it. In some species there is a third horn in the center of the forehead and still others have an additional pair of small ones immediately behind the major horns, making five in all.

The giraffe lives in fly- and tick-infested country and thus the tuft of long black hairs on the tip of the tail is a convenient fly swatter; with it the animal can flick an irritating fly from any part of the body. Some birds help keep it free of flies but the tick birds, which feed exclusively on ticks, keep these annoying pests from becoming too numerous. The giraffe's feet are equipped with the regulation cloven-foot ungulate-type of hoof but there are no lateral dew claws and the foot may measure as much as twelve inches in length. Despite the size of its foot, the giraffe

can walk only on hard, firm earth. The long legs supporting such a heavy body would soon become hopelessly bogged down if it tried to cross deep mudflats or swampy ground.

During recent times the giraffe has lived exclusively in Africa but its ancestral home was in Europe and Asia. Northern India seems to have been the radiation center of the family and thus our modern giraffe is actually an immigrant to Africa. The giraffe family dates back no earlier than the late Miocene, about fifteen million years ago—an antiquity decidedly less than that of most mammalian families.

Early Boer settlers in South Africa were largely responsible for the rapid decline in the population of these animated skyscrapers. Giraffe flesh is quite good to eat, and—unfortunately for it—the animal has a tough hide, about an inch thick in places. It is, indeed, so tough that a soft-nosed bullet fired point blank at close range will flatten out before it can penetrate any vital part. In pioneer days there was great demand for the hide for traces, long reins and whips. The natives, too, took their toll; they relished the meat, which is excellent for sun-curing and smoking, and they prized the large bones for the great amount of marrow they contained, the strong sinews for bow strings and musical instruments, and they used the hide to cover their shields. One native method of hunting was ingenious—the pitfall ten feet deep with a wall of earth six or seven feet high across the middle. When a giraffe fell into one of these pits with its forefeet on one side and the hind feet on the other, it was helplessly balanced across the wall.

It is difficult to imagine anyone today killing the inoffensive giraffe for sport, and there is little excuse for asserting that it is a menace to man's cultivation. Indeed, there seems to be only one occasion on which it has tangled with human progress. When a 600-mile telegraph line was erected in Kenya Colony, it operated only an hour after the official opening. Trouble-shooters found that a giraffe had nearly decapitated itself by running at high speed against the wire, and three others were found entangled in it. The line was raised to a height of 30 feet and giraffe trouble ended.

The home range of the giraffe extends roughly from the Sudan on the north to the Orange river

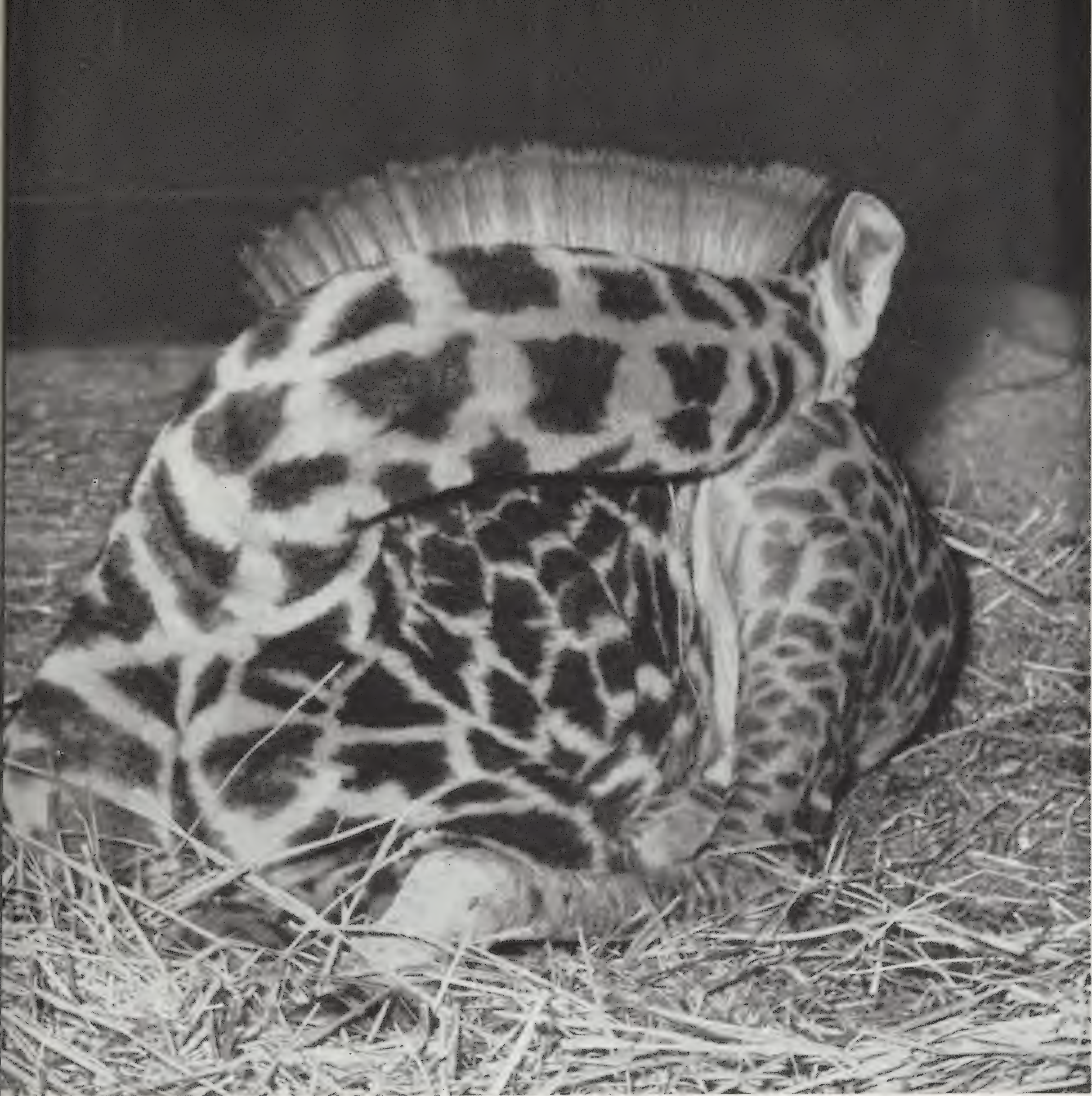
in South Africa, then up the west coast to northern Angola with a recurrence in northern Nigeria. The animal strictly avoids the unbroken canopy of dense forests, swamps and soft, muddy terrain, and a river presents an impassable barrier. It favors the firm-packed savannahs with their orchards of flat-crowned acacias.

It is a browsing animal and a cud chewer and it feeds almost exclusively on the leaves and shoots of the acacia tree. It has no front teeth in the upper jaw and the tongue is used to draw leaves and twigs across the lower front teeth and cut them off from the branches. Giraffes usually feed in the early morning and evening and rest during the heat of the day. During these rest periods they remain absolutely motionless and almost invisible against the background of an acacia tree, without the flicker of a tail or the twitch of an ear to betray their presence.

For such a tall animal, sleeping can be quite a problem. In some districts full grown giraffes (like some elephants) do it the easy way and sleep standing up. Not only does it involve considerable effort for a giraffe to lie down and get up, but at such times the animal is an easy target for lions. Nevertheless, giraffes do sometimes sleep lying down, with the neck turned backward and the head resting on the rump.

Giraffes are sociable animals and love company. They live in loosely knit communities but family circles usually keep close together. Groups of four or five and up to twenty individuals are not uncommon. Occasionally an old bull lives alone but even these patriarchs may rejoin the company at times. Herds of well over a hundred and fifty animals have been recorded in the past, but they probably represented some sort of migration rather than social gatherings. In recent years the largest number recorded as seen together was seventy.

Like elephants, giraffes roam over large areas. An old bull may be the official leader of a herd but it is the females that keep diligent watch, not only over their own young but for the herd in general. A large herd consists of an adult bull, cows, calves of various ages and some grown males not yet sufficiently mature to raise serious competition with the herd bull. A fixed mating season has not been determined, but mating frequently occurs about March. The young, all legs



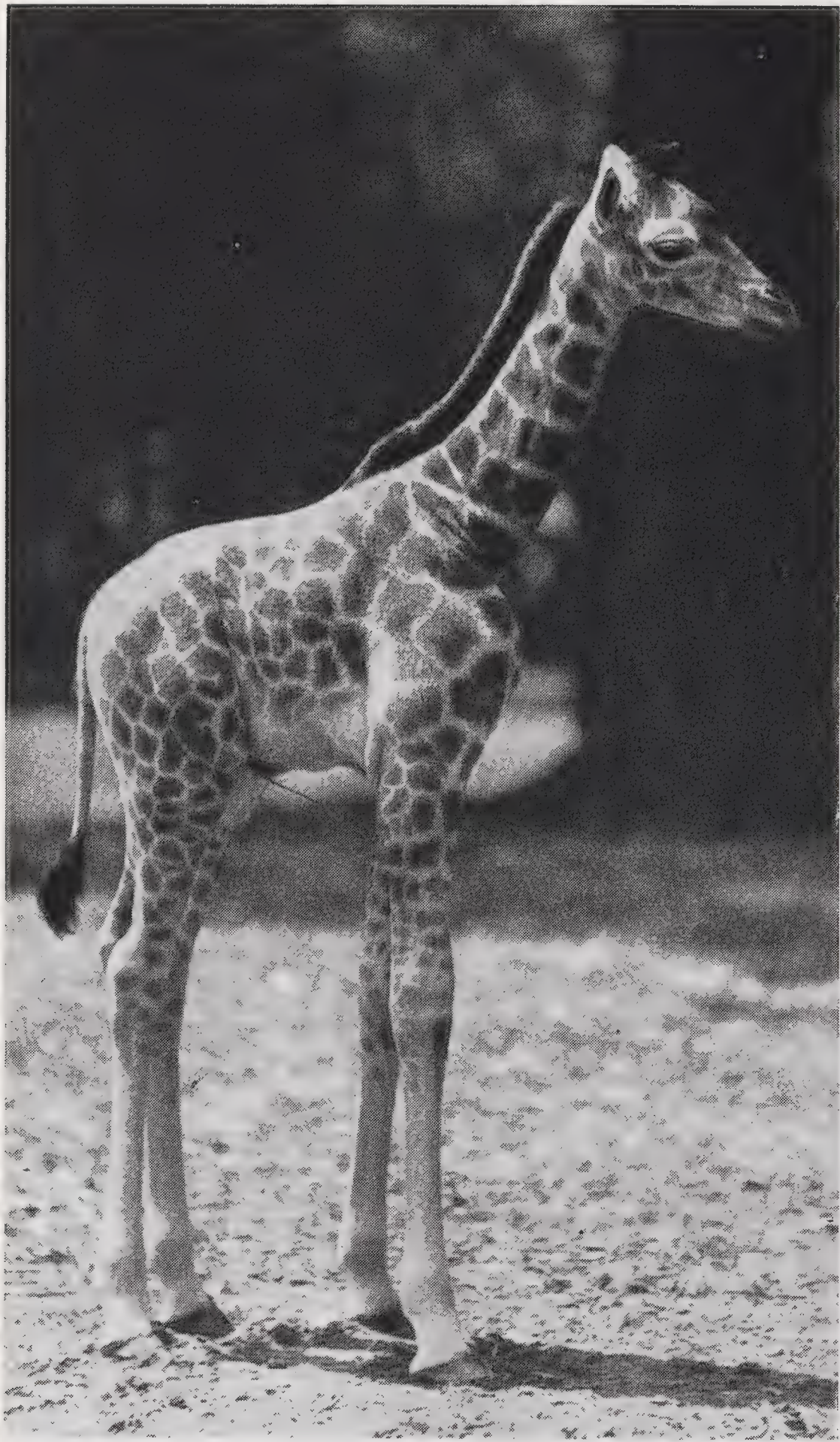
Giraffes often sleep standing up, but when they lie down to sleep they assume this curious posture with the neck turned backward and the head resting on the rump. Lying down, they are an easy prey for lions.

Photo from Siegrist, Basel

and neck but still very comely, are born about fourteen and a half months later. A single calf is the rule but very occasionally there are twins — never more. The mother has only two teats and a third calf would complicate matters. A newborn calf weighs from about 110 to 140 pounds, and stands five and a half to six and a half feet tall. In twelve months it increases its height to about eleven and a half feet. Twenty minutes after birth the calf has been licked clean by the

mother, a ritual of ownership, and is ready for its first meal. Staggering uncertainly at first on its long, wobbly legs, it reaches its mother's side. During these early days the baby braces itself between the mother's forelegs while feeding. For the first nine months it is dependent on her milk for food, but after this it is tall enough to reach the lower branches of trees and it begins to feed itself. Both parents will vigorously defend their young and it is a foolhardy predator, be it man or lion, that incautiously comes within striking distance of the female giraffe's mighty hoofs.

Where there are several calves in a herd, they frolic together like the young of most other animals.



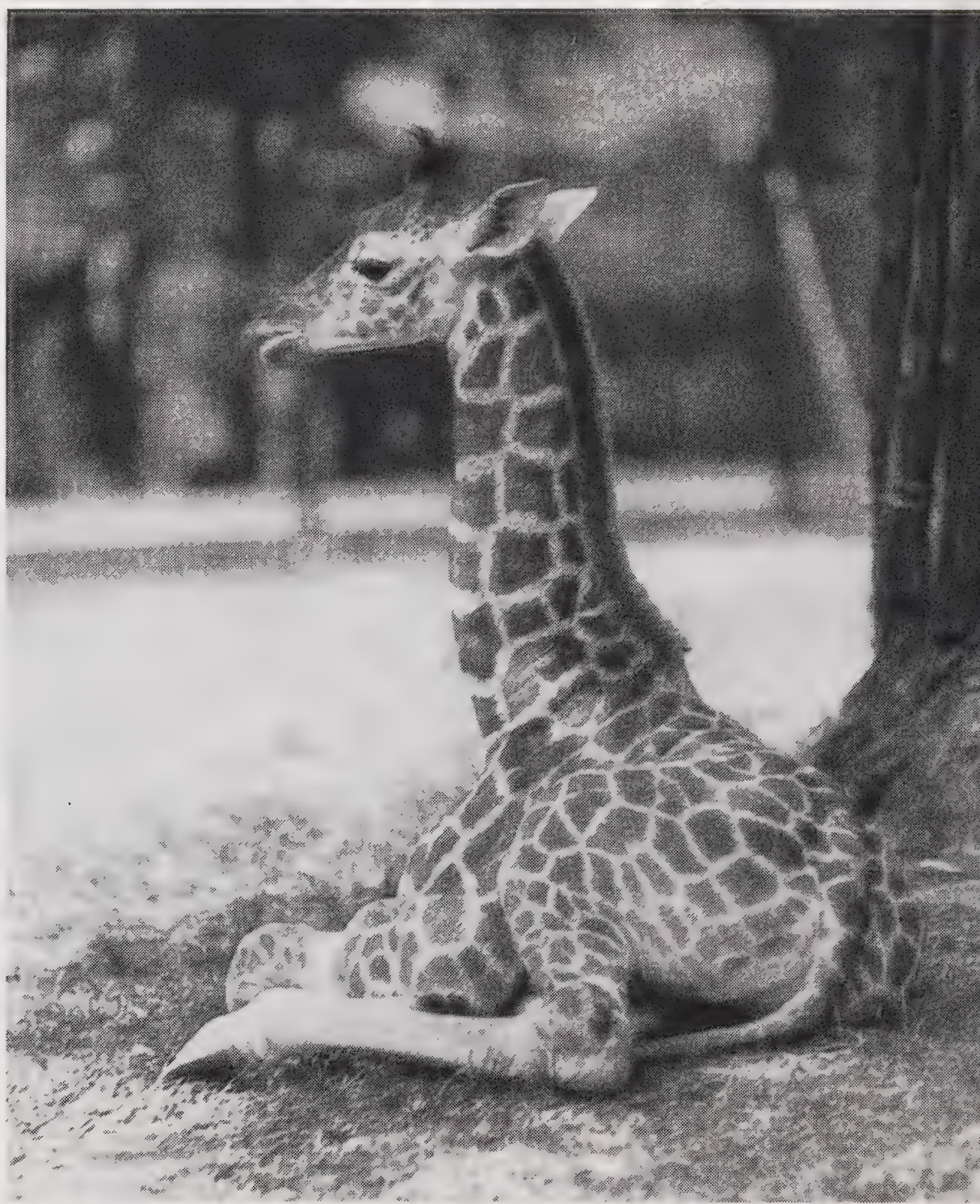
Jack, a young Nubian Giraffe, was born in the Zoological Park and grew to adulthood here. Babies stand 5½ to 6½ feet high, and weigh 110 to 140 lbs. Single calves are usual.

Fifteen to twenty years seems to be the average good life span of the giraffe, but there are exceptions; one patriarch lived in captivity for 28 years.

Competition between bulls for possession of the cows is a familiar behavioral pattern, but the way by which giraffes settle their quarrels is one of the strangest in the animal kingdom. The bulls hammer each other with their heads.

In beginning a fight, two opposing bulls sidle up to each other, their heads swinging up and down. They continue this movement until one finds an opening and then he swings his neck sharply sideways and downwards, bringing his rugged horns down with a powerful blow on his

adversary's shoulders. By now the battle is on in earnest. The other bull may toss his head backward to escape the blow and try to bring his head and horns down with a smashing thud upon the shoulders or neck of the attacker. All caution is abandoned and both animals pound each other mercilessly about the neck and body with their massive heads. At times, in an effort to add power to a blow, one will partly rise up on its hind feet. The battle continues until both bulls are exhausted and then, as if by agreement, they stop to rest before resuming.



Sometimes one bull will lower his head between the forelegs of the other and bring it up with a mighty heave in an attempt to throw his adversary back on his haunches. Often, too, one giraffe will miss its mark and hit the ground with a dull thud. These battles are fought in silence, each giraffe viewing the other with changeless, melancholy eyes. Usually the battle ends from complete exhaustion, and except for bruises neither animal seems much the worse for the pummeling. It is conceivable, however, that a well-aimed blow from a hundred-pound head used as a club on a seven-foot neck might have serious consequences, and on occasion giraffes

have been found with dislocated or broken necks, believed to be the result of these battles.

A giraffe can kick in all four directions, and a hoof twelve inches wide, swung on a seven- or eight-foot shaft of heavy bone and muscle and backed by terrific driving power, can inflict a smashing blow and has been known to decapitate an over-anxious lioness.

Lions sometimes kill a full-grown giraffe, but it is only when they are hard-pressed by hunger and they can catch the giraffe at a disadvantage that they will make the attempt. A single lion is no match for a giraffe but if two or more strike when the animal is reaching down to drink and has its legs spread wide apart, they have a good chance.

A giraffe never approaches a water hole until it is certain that no danger lurks nearby, and it does not drink from rivers. Where water is plentiful, it may drink regularly and consume about

two gallons a week. Cows with calves need more water than the bulls. In dry regions, giraffes often go for weeks without drinking and get their moisture from the green vegetation they eat.

The great height of the giraffe demands a very high blood pressure to drive the blood up to the lofty head. On the other hand, when the animal drinks its head is lowered seven feet below the level of the heart, and a few seconds later it may be lifted nearly twenty feet in the air. To prevent a possible brain hemorrhage when the head is lowered, or the sudden drain of blood from the brain when it is rapidly raised, the blood supply is instantly shunted through direct short-cut channels controlled by reflexes.

It is not easy for a giraffe to bend to the ground and in this awkward position it is vulnerable to an enemy. The heart mechanism that supplies blood to the head, either up or down, is now being studied.



For years it has been said that the giraffe is mute, that it never makes a sound. The fact is that occasionally a cow giraffe has been heard to call her calf with a low moo, and other sounds are sometimes uttered by the animal. A post-mortem examination of an adult bull that had made several sounds, between groans and moos, before dying, revealed that it lacked vocal cords. The sounds were presumably made by strong exhalations of air.

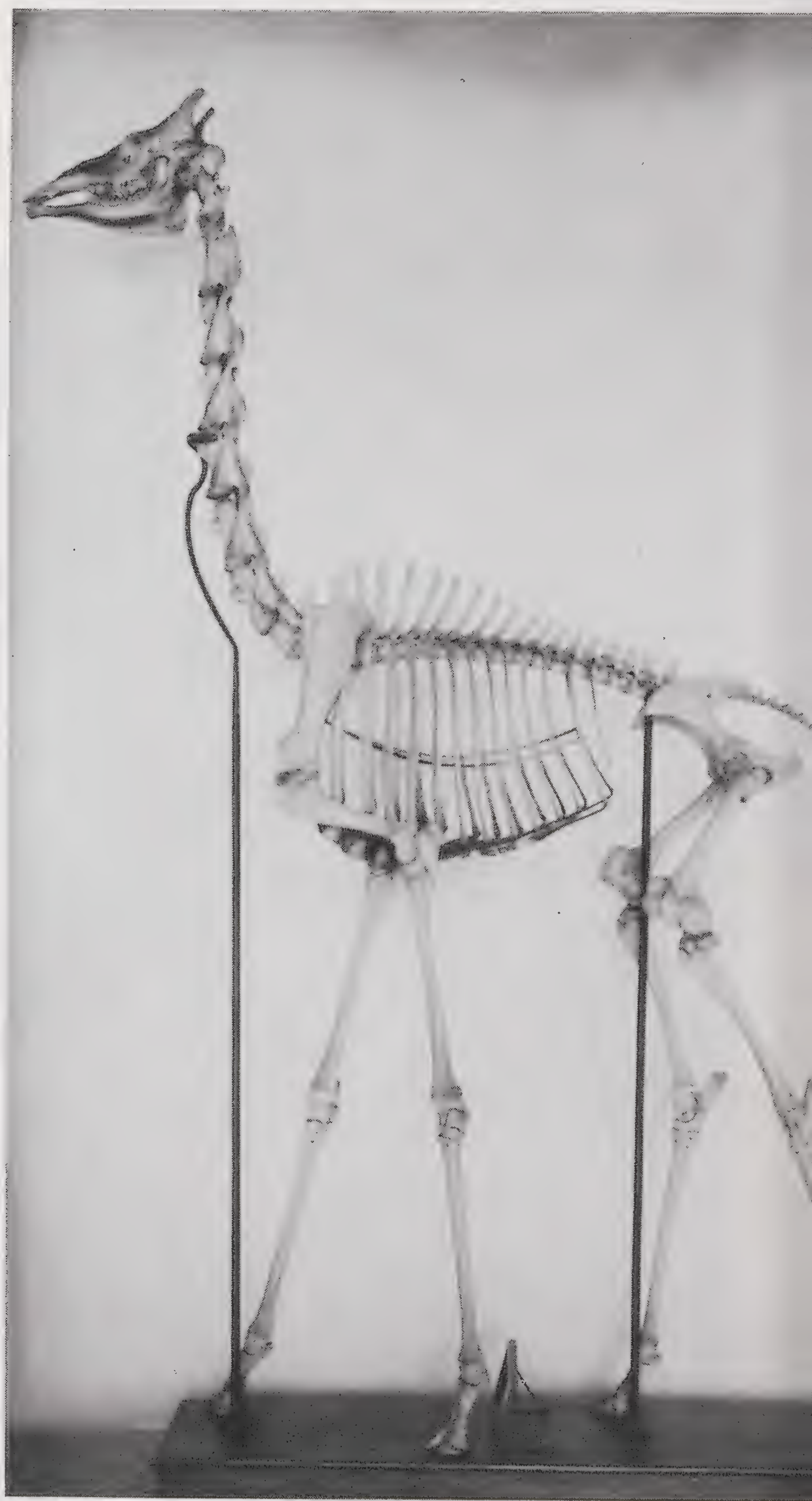
Giraffes moving at full gallop along the African skyline seem to roll along with marvelous grace and rhythm. They may walk, trot, canter or gallop. Top speed seems to be about 32 miles an hour, as timed by a car speedometer. The characteristic gait of the animal, however, is a rolling pace when both legs on one side of the body move forward together, producing an even, swaying motion something like the rolling of a ship at sea. The action of both legs on one side

Full-grown bull giraffes are often 19 feet tall and some are even taller. At the left is a particularly fine specimen of the Masai Giraffe. The skeleton shows the greatly elongated vertebrae in the neck. These are seven in number — the same as in man and the other and much shorter mammals.

Photo from British Information Services



Photo from Smithsonian Institution





The white giraffe that the author came upon unexpectedly was paired with a normally-colored animal. Both fled, but the white one was unusually shy. It is under protection now.

Photo by the author

is not quite simultaneous. The hind foot is raised a considerable distance up and forward from the ground before the front foot on the same side is raised, which may explain why there is so much controversy over the gait.

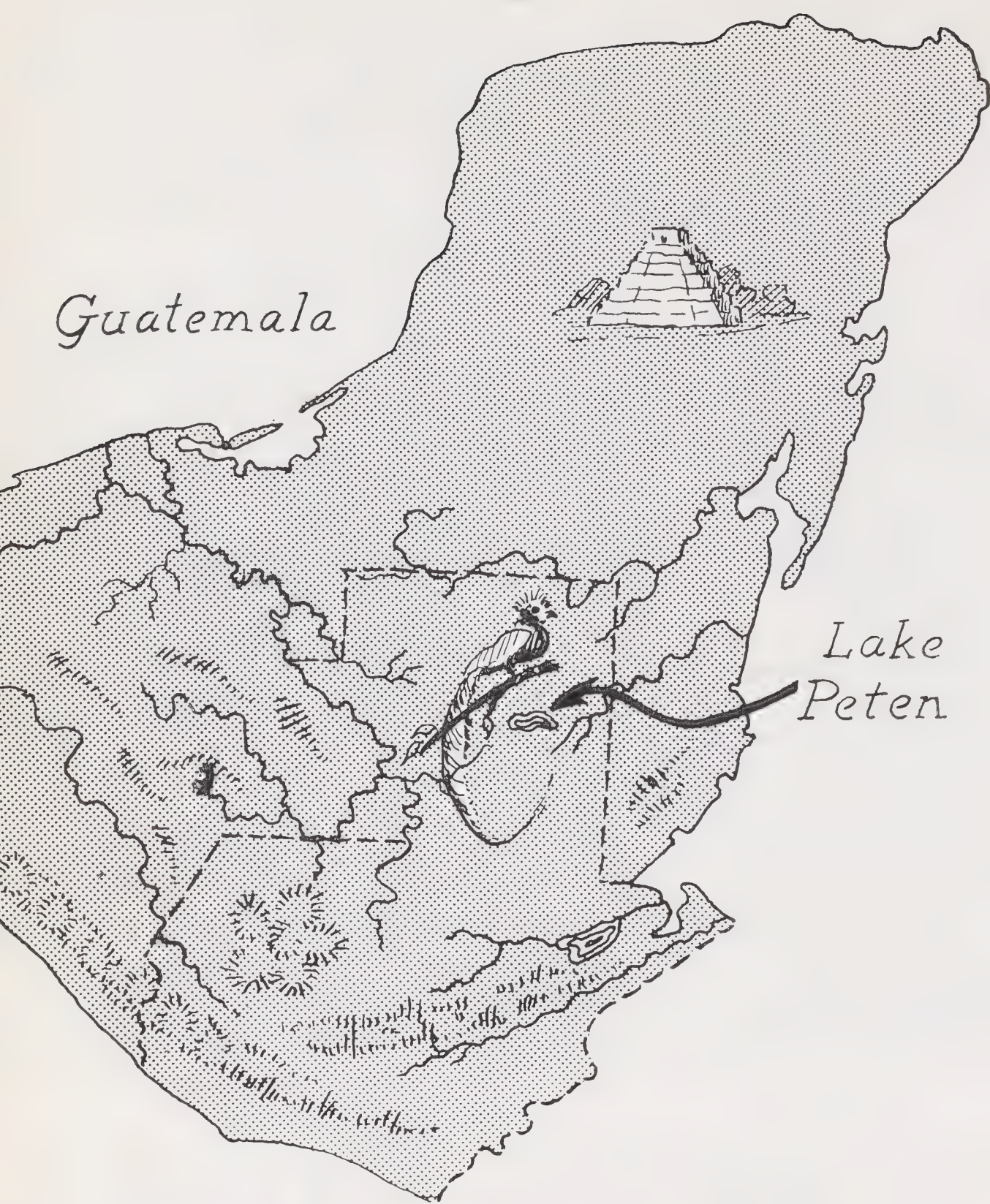
To most laymen a giraffe is just a giraffe, but zoologists distinguish twelve different kinds, each with characteristics peculiar to the region where it lives. The differences are really quite marked and are most noticeable in the variation and arrangement of the light and dark markings.

It seems that a definite geographical pattern correlated with the effect of sunlight can be drawn for the variation in the marking of the giraffe. In the equatorial regions the spots and lines are sharply separated and in strong contrast, indicating a region of very bright light and equally dark contrasting shadows. Further south the sunlight becomes softer and the shadows more diffused, and the spots on the giraffe become softer and fade gently into the whites.

During my stay in East Africa I never ceased to marvel at the towering height and quiet dig-

nity of these graceful creatures. Imagine my reaction one day when, off in the distance, something white and alive moved across an opening in the trees. Stalking the creature brought me face to face with a snow white giraffe! In my astonishment I did not, at first, notice that it had a mate of normal coloration hidden in the trees close by. The white giraffe seemed unnecessarily restless and nervous, as if fully aware of its conspicuousness. Both giraffes came out in the open, paused for a second, and then crossed paths so that the white giraffe was outlined in a magnificent picture against the dark one.

In a moment the white giraffe took off at a fast gallop toward a dense orchard of acacia trees, as if intent on hiding its retreat, while the dark one bounded off into the open. On reaching the bush the white giraffe did not slacken its speed but instead swung its head low under the branches and threaded its way between the trunks of the trees. I could see its white head and neck sway back and forth in rhythm with its rolling gait. Coming out on the other side of the orchard it never paused but continued on at a fast rate and vanished over the horizon. It was the first and last white giraffe I saw among the many that crossed my path and I am glad to say that subsequently it was placed under government protection and is safe from trophy hunters.



Platyfish Come from Strange Places

By MYRON GORDON

THERE IS NO RED-CARPET SERVICE for passengers on the Aviateca twin-engine plane that flies from Guatemala City to Flores and other dots on the map of Guatemala's jungle province of Petén; passengers rank a poor second to freight in importance.

"As for departure, Señor, the plane departs when it can," the Aviateca agent informed me with an earnest air of making everything clear and understandable. A genial, unhurried man himself, he perhaps saw no reason why anyone else should be anxious to go anywhere.

Nor, on second thoughts, did I. The inch-long platyfish that were the object of my journey had existed in Lake Petén for at least 25,000 years and would presumably go on existing for another day or two. And so I leaned against the shady side of the unpainted hangar at the Guatemala City airfield and enjoyed the spectacle of a tropical freight plane's cargo being shifted. Bales of raw hides tumbled out of the hatchway, so fresh that the fine red bloodvessels were still imprinted on them. Salt-glistening slabs of sun-dried fish slid out and, reeking, were carried away. I wondered whether the enormous cubes of congealed chicle that followed them would end up as

fish-flavored chewing-gum. Bags of flour and rice and drums of gasoline were stowed aboard and when it seemed that nothing else could possibly be squeezed inside, I was summoned by the pilot to scramble over the cargo and take the one seat that had been left free of supplies. And then we were off on an hour's flight to Flores in the north.

Flores is a island-village in Lake Petén, and Lake Petén is a blue-green ornament of the lowland jungle. Flores was to be my base, and in Lake Petén I expected to find a platyfish of a distinct race, for it was here in 1935 that Dr. Carl L. Hubbs had dipped up specimens that were the first (and only) ones I had ever seen. Now my own work in the genetics of swordfish and platyfish had reached a stage at which it was important to study this particular race in its relation to black cancer.

The Flores airfield is a grassy strip on the mainland and the arrival of a plane is the signal for drivers of "water taxis" to swarm, offering their dugout canoes with outboard motors. For half a dollar they will carry you across the choppy water to Flores.

I came armed with a letter to a Señora Castellanos directing her to put the vacant house of a friend at my disposal, and in a village as small as Flores — a third of a mile of red-roofed houses clustered around a church — it was easy enough to find Sra. Castellanos. Within an hour I was master of my base — except that I had to share the courtyard of the house with a sow, six chick-

ens and a noisy, scrawny rooster — and the teenage daughter of the Castellanos family had served me a simple but excellent dinner. It is often true that in the tropical countries life moves at a very slow pace and it seems to take forever to get anything done; it is also true that quite often things do move smoothly and efficiently. In fact, it was I who had a feeling of being rushed that late afternoon. Señor Castellanos came to call, accompanied by Sr. Pinelo, the local Aviateca agent, and we got to talking about (naturally) fishes.

I showed them the long-tailed swordtail and the chunky, shimmering green platyfish that I was looking for. Neither of them had ever seen the swordtail — they were amazed at its beauty and graceful form, and more amazed to learn that it was one of Guatemala's native fishes. The

The grassy shore of the island of Flores in Lake Petén. It was in a muddy inlet on the mainland, opposite this spot, that Dr. Gordon seined up the fish he was seeking for his laboratory work on melanomas.

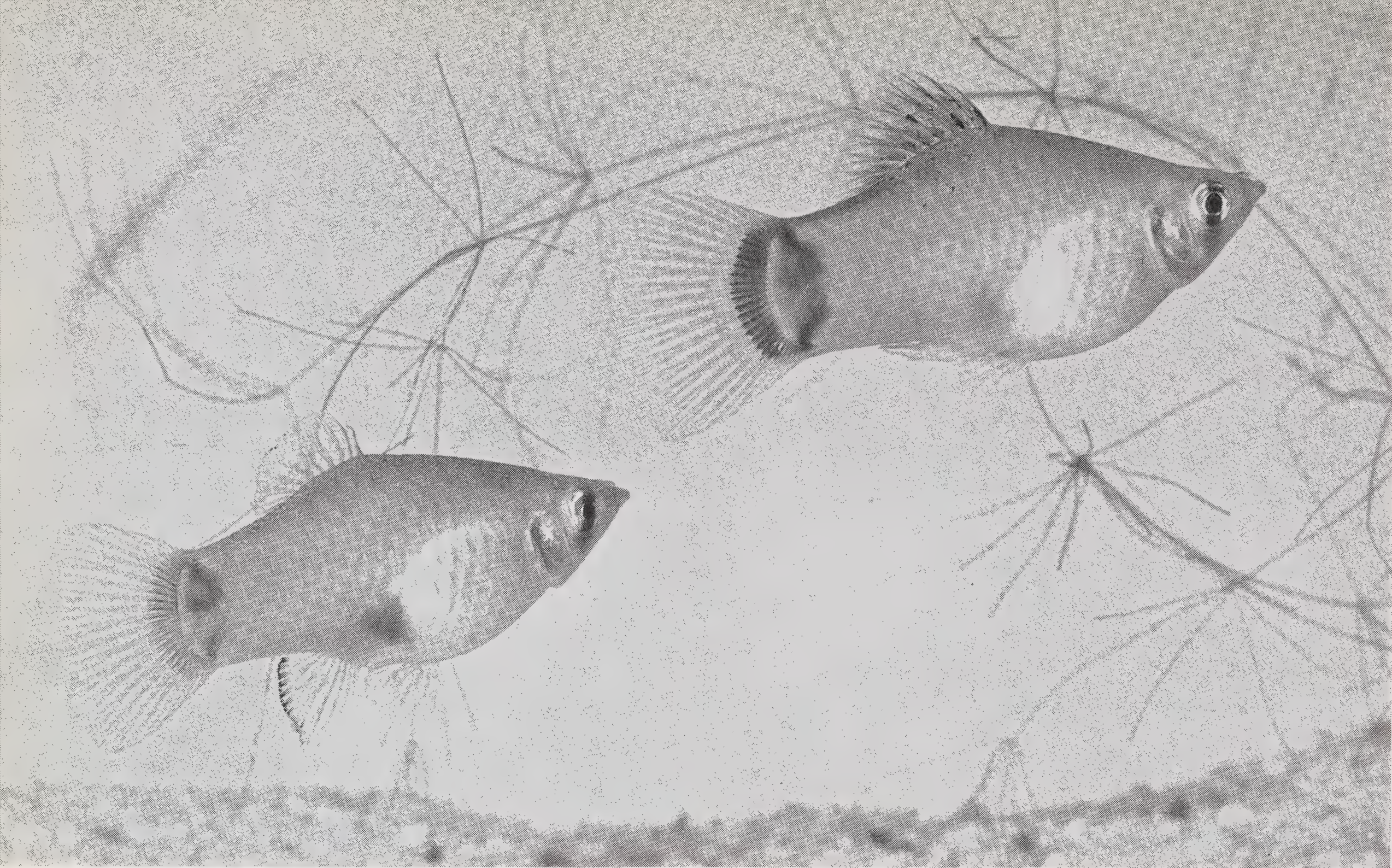
platyfish, they said they knew. "Why, it is everywhere, along the lake shore right at Flores."

"Would you like to start right away catching the fish along the lake shore?" they asked with eager expectancy. I knew that platyfish would not be found along the open beach area but just the same I said, "Bueno, good." I did not want to dampen their enthusiasm.

The shoreline was like a parking lot for dugout canoes; some were large, some small, all close together. We used them as a boardwalk to get to shallow water three or four feet away from the muddy shore. As Señor Castellanos flashed his electric light down I saw many giant-sized, orange-finned mollies and tiny, pale mosquito fish lying quietly in the silty waters. They were easily caught in my small net.

Soon Pinelo's sportsmanship spirit awakened and he asked me to let him try netting the fish. Then Castellanos' enthusiasm for the catch was aroused and he took the net. All of us caught many of the small, lethargic fishes, but as I suspected there were no platyfish among them.





These little platyfish — *Xiphophorus maculatus* — were the goal of the expedition to Lake Petén. Only a few were brought back, but they reproduced readily and now Dr. Gordon has hundreds for research.

In the meantime, the strange goings-on at the waterfront had attracted the small boys of the village. They swarmed about us, jumping from canoe to canoe and scared the sleeping fish. Pinelo and Castellaños gently scolded and urged them to stay back, but it was like shooing flies away from an open sugar bowl.

Gradually my collecting bottle of formalin preservative began to fill, for I took this opportunity of getting a good representative sample of the fishes of Lake Petén. Suddenly Castellaños spotted a *culebra* — a water snake, about 14 inches long. He looked at me in a questioning way that meant “Do you want it?” At my nod he went after it. In the alternate darkness and flashing light the snake was confused and moved closer to shore where finally Castellaños got it in the net, but only for an instant. It slipped out and fell along the muddy bank. Just as it was about to get back into the water, I put my foot on it, pinning it in the soft mud. Later, at the American Museum of Natural History, Curator of Reptiles Charles M. Bogert declared that it was a rare,

mildly venomous water snake, *Coniophanes quinquevittatus*, the third and largest one ever found. Curiously, the second one had been taken in 1935 almost at the same locality by Dr. Hubbs. Nobody knows where the first type specimen of this rear-fanged colubrid was caught.

When the bottle was full of specimens, I asked the fishermen to have a beer with me at the local grocery. It was no supermarket, but it had a pool-room and it was the sole recreation center alongside the waterfront. Over our drinks we planned the morrow’s trip. I told them I wanted to explore a small spring and brook that I had seen near the airstrip on the mainland. The platyfish might be there.

At six-thirty I had a Castellaños breakfast — cereal, fruit, fried eggs, chili con carne, tortillas, fried potatoes and tea. At seven, Señor Pinelo arrived, right on schedule. Flores rises late, and it was through deserted streets that we walked the rough cobblestones to the shore where a boy in a tattered shirt and dungarees was waiting for us in his canoe. As we approached the mainland, water lilies and arrowheads trembled in the clear, shallow waters in our wake. Schools of silver-sided characins, solitary greenish cichlids and shadowy catfish scooted by as if they were caught in a huge, beautifully waterscaped aquarium.

Pinelo was eager for me to catch some of them but I made the excuse that the water was too deep. The ones I was seeking, I felt, would probably be found in the inlet brook that formed a channel in the marshy shore near the airstrip. Near its source the inlet narrowed to the width of a good jump, and to my surprise its water was muddy brown. There was nothing mysterious about the reason: two huge, coal-black sows were wallowing in the heart of the spring.

Sr. Pinelo gave up trying to understand my kind of fishing when I prepared to drag a net in a hog wallow. I had some doubts, myself, when I slid down a mud bank into muddy water and maneuvered the four-foot-square seine along the bottom and well up under the overhanging banks. Pinelo and the boy helped me lift the seine out. It was heavy with water hyacinths, aquatic weeds and masses of oozing mud, a most unpromising catch.

I shook each cluster of long-rooted plants vigorously over the seine before I threw it to one side; then I looked carefully for the precious specimens that might be hidden in that muddy mess. I caught a glimpse of a bit of greenish iridescence, and there, imbedded in the mud, was the slim form of a platyfish. Then I found another, and another. Pinelo and the boy were astonished. They watched the fish swimming about in the clear lake water of my glass canister and admitted they had never seen a platyfish before. "*Muy bonitos*," they said.

I do not know whether, 18 years ago, Carl

Hubbs collected his platyfish at this identical locality, but I can certainly confirm his statement that their habitat is "Lake Petén at Flores," for I got nine females and three males there.

Now, many months later, in New York City, the Lake Petén platyfish are well adjusted to the luxurious quarters of the Zoological Society's Genetics Laboratory at the American Museum of Natural History. The dozen specimens I brought back alive have multiplied and are now several hundred, and I believe that as of this moment there are more platyfish in New York City than in Guatemala's Black Sow Wallow — for in my notebook that is what I named that brook.

The problem I hope to solve with the aid of the fishes that live in the jungle waters of Central America goes back to prehistoric times. The platyfish from Lake Petén and their neighboring races from northern, eastern and western rivers live harmoniously together in laboratory aquaria. By mating them in various ways I hope to get information from their offspring that will tell something about the devious migratory river pathways they took more than 25,000 years ago to establish many races today. The solution to this problem may tell us why some races, long separated in time and space, when mated produce hybrid offspring, some of which are more vigorous than their parents, while other hybrids that are black spotted are unfortunate in their heredity and develop black cancerous growths.

Hortense Has No Tail to Tell

By JAMES A. OLIVER

THERE IS A WIDESPREAD BELIEF that you can tell the age of a rattlesnake by the number of segments in its rattle. A snake with a string of eight rattles is said to be eight years old, while one with three rattles is thought to be only three years old. Unfortunately, this is not true. The rattlesnake with eight rattles may be only three years old and the one with three may be eight.

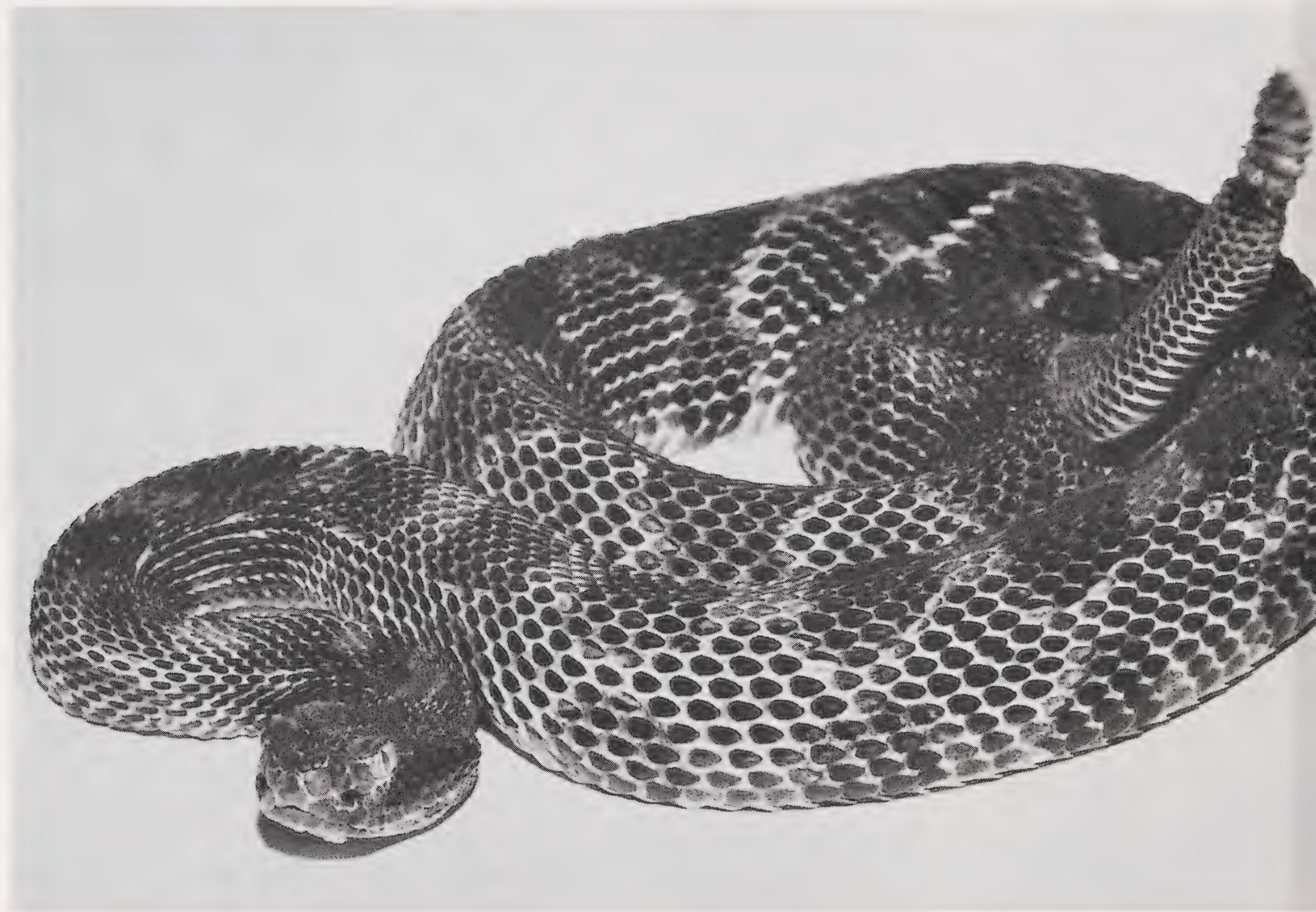
Actually, if the set of rattles is unbroken, an experienced herpetologist can deduce the approximate age of the snake — but not on the basis of a single rattle for each year. Studies of rattlesnakes in the wild by Henry S. Fitch, Angus M. Woodbury, F. La Marr Heyrend and Anson Call show that young rattlesnakes may acquire two or three rattles in one year. Snakes slightly more than two years old usually have six or seven rat-

tles. After three years of age most rattlers in the wild do add a single rattle each year. The exact number varies with the individual snake and the locality. Laurence M. Klauber, the foremost student of the rattlesnakes, has reported the exceptional condition of captive-reared Western Diamondback Rattlesnakes (*Crotalus atrox*) 27 months old with strings of 14 to 16 rattles.

The rattle is a fragile structure and in few rattlesnakes more than four or five years of age is it complete. The longest string of rattles ob-

recapturing them over a period of years. This requires painstaking field work and must be carried on over a long time, during which a fair number of marked snakes are captured. Using this method, Henry S. Fitch recovered a Northern Pacific Rattlesnake (*Crotalus viridis oreganus*) that had definitely lived 17 years in the wild and he calculated that some he first marked as adults lived to be at least 20 years old.

Recently the Russian scientist V. L. Bryuzgin has developed a method of staining and studying



served by Dr. Klauber on a snake in the wild had 16 segments. Such a long set is very unusual. Longer sets of rattles can be produced artificially by gluing several rattles together and snakes with such long sets are sometimes seen in reptile shows or carnivals.

Since the rattle does not provide a method of determining the age of rattlesnakes, how *do* herpetologists get information on their length of life? Data on the life span of snakes in the wild have been acquired by marking individuals and

the annual growth circles on certain bones in the skull. This method has not been applied to the study of age in rattlesnakes, but has been used on a limited scale in studying snakes in Europe. It is interesting to note in passing that A. Petter-Rousseaux applied this technique in his study of the European Grass Snake (*Natrix natrix helvetica*) and found one snake 19 years old.

Most of our knowledge of longevity in snakes has been acquired from individuals living in captivity. Animals under the artificial conditions of

captivity are not exposed to the constant dangers besetting those in the wild. The captive snake is offered food and water regularly, is free from the attacks of predators and many parasites, has its more obvious ailments treated and is not subjected to extreme environmental changes. Under these favorable conditions the maximum ages may not coincide exactly with those of snakes in the wild, but are probably longer in many cases. The longevity records of captive snakes do indicate something of the potentialities of the species. The maximum known age for any snake is 29 years, recorded for an Anaconda that lived in the National Zoological Park in Washington.

The greatest life span definitely known for any rattlesnake is 20 years. This record has been set by a Western Diamondback Rattlesnake (*Crotalus atrox*), still living in the San Diego Zoo, that has been on exhibition since May, 1936. The late C. B. Perkins and his able coworker, the present Curator of Reptiles, Charles E. Shaw, have recorded the most outstanding series of longevity records for snakes in captivity. For example, of the 14 rattlesnakes that have lived in captivity in the United States for more than 10 years, 10 have lived in the San Diego Zoo. This enviable accomplishment is a tribute to Perkins' and Shaw's skill in caring for captive reptiles.

But longevity records for captive snakes are not always established in large zoological parks. A surprising number have been made in private collections and small museums. In the private collection of John G. Moore an Indigo Snake (*Dry-*

This female Timber Rattlesnake, named Hortense, is believed to hold the longevity record for her species, having been collected 19 years ago in Massachusetts. Her short rattles give no clue to her age.

marchon corais couperi) is still living after 24 years in captivity. George P. Meade has a specimen of the Louisiana Milk Snake (*Lampropeltis doliata amaura*) that has been in his care for 20 years. Among the rattlesnakes, the North Carolina State Museum once had an Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) that lived for 14 years and 9 months. Tabor College had a Swamp Rattler or Massasauga (*Sistrurus catenatus*) that also lived for 14 years. There are probably a number of unknown old-age

record-holders now housed in private collections, small schools or local museums awaiting discovery and the chance to add their bit to our knowledge.

Recently we unexpectedly received one of these unacclaimed oldsters, a new record holder for its species. The specimen is an ordinary-looking dark female Timber Rattlesnake (*Crotalus h. horridus*) that was collected in 1937 on the cable tracks at Mt. Tom, Massachusetts. It was a mature individual when caught and gave birth to 18 young a few days after capture. From 1937 until July, 1955, it lived in the Museum of Natural History and Art of the Holyoke Public Library in Holyoke, Massachusetts, under the care of Mrs. William S. Quirk, Director. A change in exhibits in the summer of 1955 left little room for the rattler and it was given to the Fairbanks Museum of Natural Science in St. Johnsbury, Vermont. Frederick H. Mold, Director of the Fairbanks Museum, appreciated the value of the rattler as a live exhibit, but felt the need for a snake that could be handled by young visitors. Therefore he offered to trade "Hortense," as he called her, for something less dangerous.

We pointed out that Hortense appeared to hold the longevity record for her species and was thus a prize exhibit, but Mr. Mold did not consider this as important to his visitors as a snake they could touch and handle. He wanted to go through with the trade — much to our delight. Hortense was delivered to us safely on February 19, 1956. Like some females of other species, her appearance gives little clue to her age. She is comparatively small and slight of build for her species, but has a good appetite and is alert.

Prior to the revelation of Hortense's age, the oldest known Timber Rattlesnake was — as you may have guessed — in the San Diego Zoo. It lived there for 15 years and 7 months. We hope our own new record-holder will live for many more years.

On her tail she now bears five rattles, including a brand new one acquired on February 26, 1956. She is getting ready to shed her skin again and should acquire another rattle at that time. This will make two new rattles in about two months, an unusual number for an old Rattlesnake. Perhaps she is going to get a much longer set of rattles, more in keeping with her ripe old age.

SPRINGTIME IN THE ZOO

Photographs By SAM DUNTON

The African Plains exhibit has never looked better to a herd of **NYALAS**, a young Zebra and two young Oryxes birds of previous years. There are 18 birds in the exhibit just been released from the shelter house and is making a spectacle that never fails to delight visitors, who g

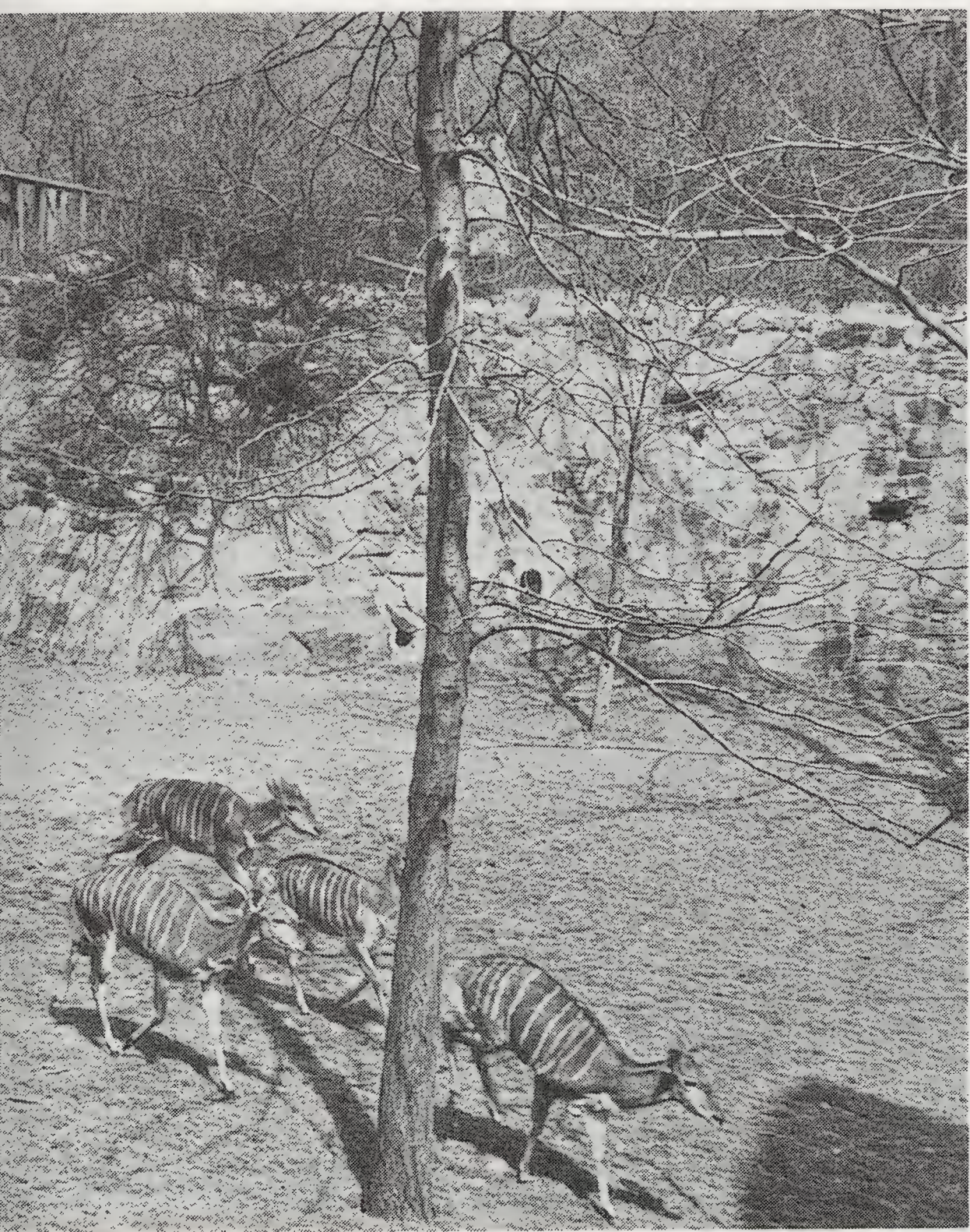


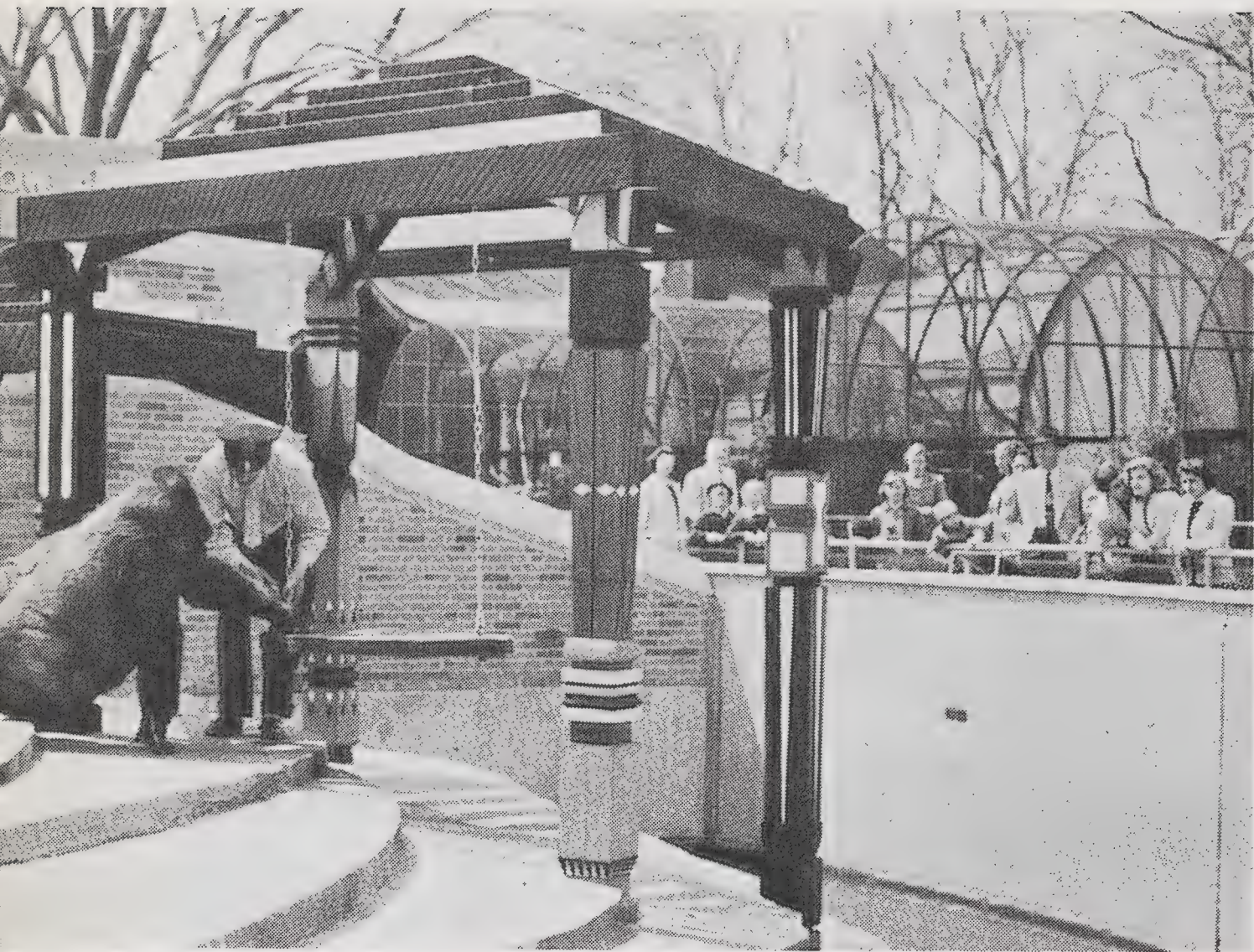
All winter long, Little Joe, the **AFRICAN BLACK RHINOCEROS**, was locked up inside the steam-heated Elephant House. His compartment is comfortably large with plenty of room for exercise, but nothing takes the place of fresh air and spring sunshine. When he was allowed out of doors for the first time in late April, Little Joe celebrated his release by racing from one end of his corral to the other, snorting and whirling and digging up the earth with his horn. Here, on his first day out, he is just starting a wild dash to the end of his corral.

spring, with a magnificent
ion to the cranes and other
. Here the Nyala herd has
y entrance into the Plains,
rning to see the procession.



A baby **BLACK LEMUR** was a welcome springtime arrival on March 13. Its parents came to us from Madagascar in 1954 and have been living in the Small Mammal House, where the baby is now on exhibition with its mother. For the first few weeks the baby (which we think is a male) was carried on the mother's back but recently it has been making exploratory trips on its own. Four Black Lemurs have been born here in the past, the first in 1903 and the most recent in 1917.





1



3



2

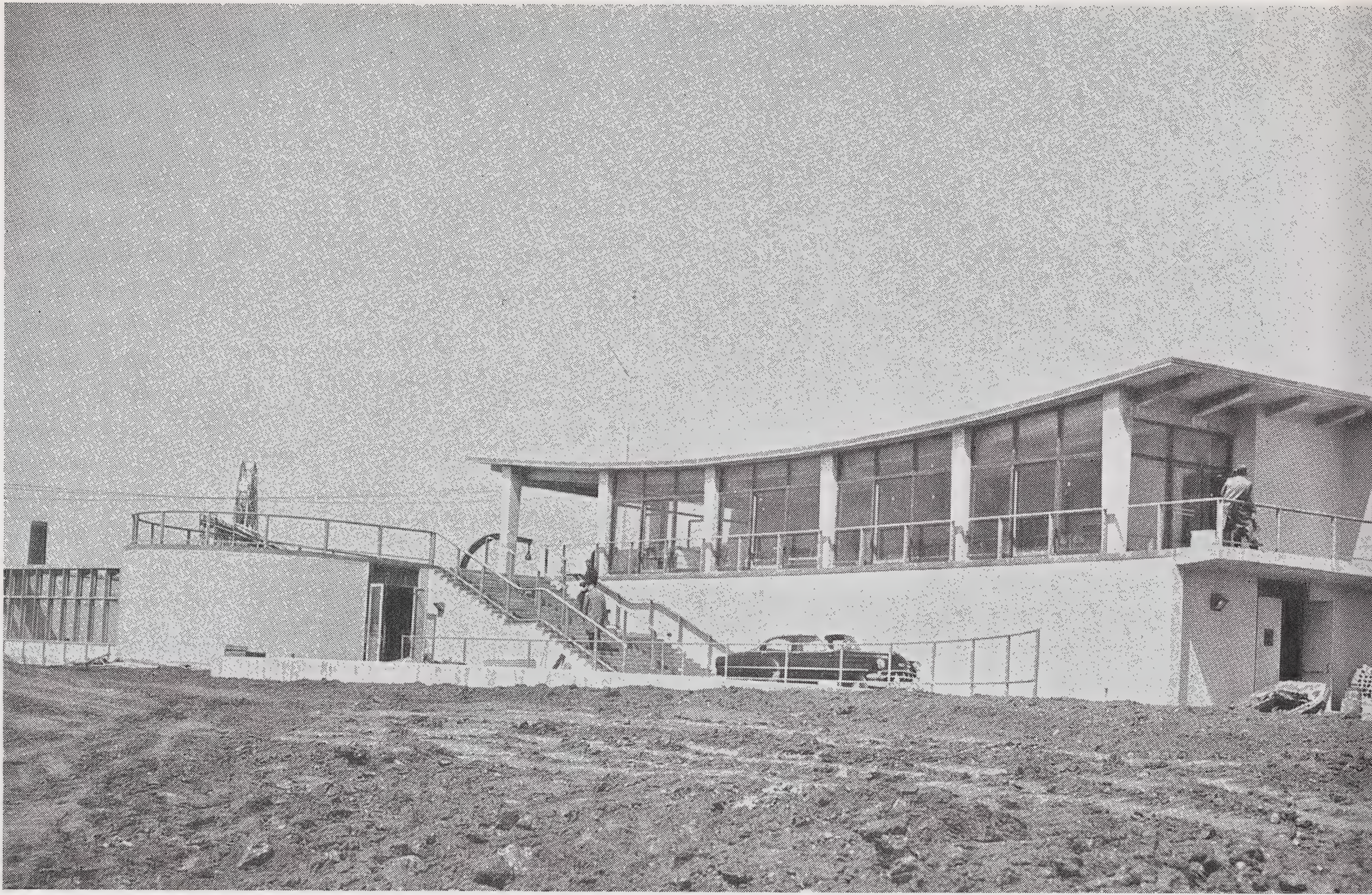
These photographs hardly need comment, except to identify the animal that is obviously having such a good time as Oka, our 330-pound female **LOWLAND GORILLA**. Swings and climbing structures are being installed in all the out-of-doors areas at the Great Apes House, and Oka's was one of the first to be completed. In the beginning she was a bit hesitant about using the apparatus, especially the swing because it moved. Keeper **QUINN**, Oka's old friend and occasional playmate, had to conduct her to the swing and explain its mysteries. After she was convinced that it would not bite, or snap at her and could indeed be used with normal Gorilla roughness, she explored it thoroughly and then began to enjoy it as we hoped she would. On many warm days she plays so hard with the swing, and climbs so much during the morning, that she is worn out and sleeps or rests for an unusually long time in the afternoon.



4

5





It's getting nearer! This is a view of Stage One of the Aquarium as visitors to Coney Island will see it from the Boardwalk.

REPORT ON THE AQUARIUM

By WILLIAM BRIDGES

A FEW MONTHS AGO it seemed possible that Stage One of the New York Aquarium would be so far advanced this spring that we could begin stocking it with fish and hold a gala opening at Coney Island for the Members of the New York Zoological Society sometime in June. That hope slowly faded as the winter advanced and now, while we are still aiming at a May or June opening, it will be in May or June of next year.

The very wide gap between the time when the workmen leave the structure and the doors are opened to the public is inherent in the nature of the exhibits. The concrete exhibition tanks

have to be "cured" before living fish can be placed in them, and the circulating salt and fresh water, too, must be adapted to the creatures that will live in it. Plants have to be established in the new tanks. There are literally thousands of details that have to be worked out in setting up housekeeping in a new Aquarium, and none of them can be settled until the construction crews have departed and the building is officially turned over to the New York Zoological Society and the staff of the Aquarium.

Unexpected delays in getting supplies of glass and bronze, piping and heating apparatus, held up construction at critical times during the winter

—a situation not unfamiliar to anyone who undertakes large-scale building these days. Externally the building has been virtually completed for several weeks, but the final setting of tanks in place, connections to the various circulating systems and installation of special fixtures are still going on. We hope to be given occupancy of the building early this summer — too late, of course, to plant and condition the tanks and collect specimens for exhibition during the summer.

The necessary delay will at least give the staff a running start on next summer's operation and most of the inevitable "bugs" should be discovered and dealt with by the time the official opening comes along next year.

A large parking field has been built to the north and west of the Stage One building, on

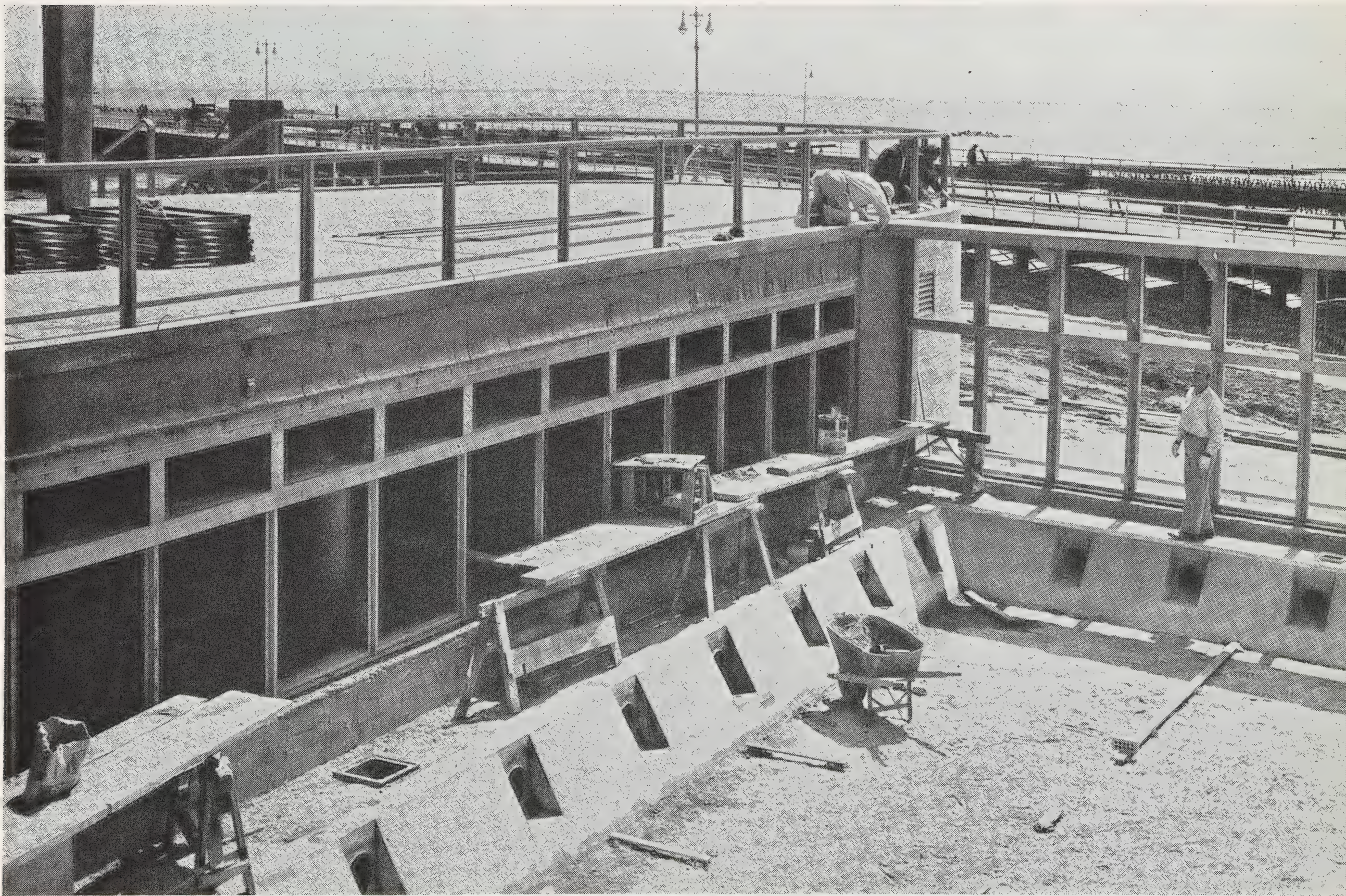
Next spring we hope the biggest Sea Elephant in the United States — a ton-and-a-half monster — will take up residence in this tank where it can be seen from above and below water.

land easily accessible to motorists arriving from Surf Avenue, with an entrance on Eighth Street. This parking field, with a capacity of something more than 300 automobiles, is virtually ready for its final surfacing and can be put in operation during the present season.

The Board of Estimate of the City of New York has been asked to amend our contract with the City so that the parking field can be put to use immediately.

Until Stage One is actually in operation, the "interim" Aquarium in the Lion House in the Zoological Park will of course be maintained. It has served a valuable purpose during the past fifteen years in keeping a highly-specialized staff together and in giving an opportunity to test new methods of tank-building and labelling, all of which will be put to use in the new structure on the ocean front at Coney Island.

As things now look, we can definitely promise that the Spring Garden Party for Members in 1957 will celebrate the rebirth of this old and great institution — the New York Aquarium.



Courtship Ritual:

THE DANCE OF THE MANAKINS

By D. W. SNOW

Edward Grey Institute of Field Ornithology, Oxford

NO BIRDS have more surprising displays than the manakins, a family of some forty species of small, plump birds found only in the tropical parts of South and Central America. They are an outstanding example of birds in which the males, more brightly colored than the females, perform communal displays at fixed display grounds. The females visit these display grounds only for mating, after which they retire to lay and incubate their eggs and rear their young without help from the male. Birds of paradise, some of the hummingbirds, many of the grouse family, and among shore-birds the European Ruff, have rather similar group displays, but in the manakins there is, in addition, a degree of co-ordination, and even of co-operation, between the displaying males which seems unique among birds and perhaps among all animals.

Recently I stayed for some weeks (January 20 to March 3, 1956) at the New York Zoological Society's field station in Trinidad, through the kind hospitality of Dr. Beebe and his staff. There I had the opportunity to watch in detail the dances of the two species of manakin found there, the Golden-headed (*Pipra erythrocephala*) and the Black-and-white Manakin (*Manacus manacus*). Both were spectacular, and strikingly different from one another. When I had watched these two Trinidad species for long enough to be confident that I had seen the full range of their displays as given at that season, I was able to pay a five-day visit to the neighboring island of Tobago, where a third species, the Blue-backed Manakin (*Chiroxiphia pareola*), occurs. I felt that this species must, by contrast, prove a disappointment; instead, it turned out to be even more amazing than the other two.

* * *

The Golden-headed Manakin, a velvety black little bird with shining orange crown, is rather

common in the forested hills of Trinidad. Golden-headed Manakins inhabit the middle levels of the forest, usually between 20 and 50 feet above the ground, and choose for their display perches the bare branches under the canopy of the smaller second-story trees, partly shaded by the huge



Here the Golden-headed Manakin has reached the end of display, and is holding his pose.

100-foot trees of the main canopy. Typically four to twelve males are found together at a display ground, of which I found several. Here throughout the greater part of the day they occupy fixed positions, perhaps three or four birds in one tree, one or two in a neighboring tree, and so on, the whole group occupying perhaps three or four trees, with distances of 10 to 30 feet between each bird.

For much of the time they sit hunched and motionless, only the feet protruding from under

the fluffed body-feathers, uttering occasionally a musical "kew" or an abrupt "pt-prrrrr-pt-pt." At intervals one or more of them may suddenly start to display. His whole attitude then changes. Abandoning his stumpy posture he sleeks his plumage and stands up on stretched legs, revealing bright red and white thigh feathers, an ornament that has hitherto been invisible. Calling a sharp "zeek, zeek," he begins his display. Most commonly, he starts jumping with whirring wings to and fro between two horizontal perches about four feet apart. As he lands, he about-faces at lightning speed so as to be ready for the next jump.

Or he may behave quite differently. Flying off silently for a distance of about fifty yards, he turns, and with calls of "kew, kew" (the same as he utters when perched), begins his flight back to the perch. As he approaches, the "kew" calls become louder, sharper, and shriller, and then suddenly give place to a buzzing note. This buzz accompanies the final approach over the last few yards, which is performed at great speed, first in

a swoop which takes the bird below the level of the perch and then in a wild upward swerve, almost too rapid to follow with the eyes, which lands him on his favorite perch. The display usually does not stop here. An instant after landing, the bird, with stretched legs and colored thighs showing, body sleeked and held horizontally, "glides" backwards along the branch, taking such minute and rapid steps that the movement of the legs is not visible and he appears to be sliding as if on a greased pole. Half way through the glide, which may be for one to three feet, the wings are sometimes briefly spread and held horizontally, then at the end of the glide, as the bird stops, he raises his wings above the back, fans his tail, and holds this posture for a moment. After gliding one way he may, if his urge to display is high, turn and glide back in the other

These precipitous forested slopes in Trinidad are the home of the manakins whose display is described by Dr. Snow. The building is Simla, our Department of Tropical Research station.



direction. This is the full sequence; in less intense form one or more of the components may drop out. Backward glides may also be interspersed among bouts of to-and-fro jumping.

Occasionally females appeared, and their presence stimulated the males to continuous and intense display. Usually the females sat passively on or near the display perch of one of the males, taking no apparent interest, but once a female joined in his display, jumping to and fro between his perches after he had done so. The breeding season had probably not started when I was watching them, and mating was not seen; but Dr. Alexander Skutch, writing of the related Yellow-thighed Manakin (*Pipra mentalis*), describes how the male alights on the female's back after a circling flight which seems clearly to correspond to the swerving approach flight described here.



Backward glides bring two Golden-headed Manakins together but facing opposite ways.

When display is slack, males from adjacent perches often come together and sit near each other on a perch midway between their display perches. They appear to be drawn together and yet at the same time to be frightened or distrustful of each other; for they approach each other by sliding backwards in short stages, first one moving a little, then the other, and when they are close enough, perhaps about a foot apart, they remain constantly facing away or half away from each other. Often one appears to be the more aggressive, making little slides towards the other, who slides away an equal distance and perhaps eventually retreats with a short flight to another perch.

* * *

One can hardly walk through the hill forests of the northern range of Trinidad without hearing the snapping, clicking and whirring of Black-

and-white Manakins. Probably commoner than the Golden-headed, they are certainly more conspicuous. They gather in much larger numbers at the display grounds, which are down on the forest floor. The male never flies without making a dry whirring with his wings like the muffled stridulation of a large grasshopper, and the loud snaps and clicks that he makes with his wings when displaying are audible at nearly a hundred yards and have earned him the local name "Casse-noisette" (nutcracker).

In this species the male clears for himself a small "court" on the ground, from which he removes all movable objects such as leaves and twigs, leaving only the smooth soil, an occasional root, and such larger fallen boughs as he is unable to carry away. In the display grounds that I examined the courts were closely grouped together, three to six feet apart; at the largest I counted 70 courts, and since I watched some males displaying which apparently had not yet cleared a court for themselves, the total number of males present was probably near 100. The area of this display ground was approximately 10 by 20 yards.

All the display grounds that I saw were in parts of the forest where the canopy overhead was rather open and the ground was covered with a dense growth of saplings. Thus each court would have, growing round it, a few vertical stems, with perhaps one or two springing from the cleared area itself. It is round this court that the display is concentrated.

For much of the time the male Black-and-white Manakin, like the Golden-headed, sits more or less quietly on a perch a few feet above his court, occasionally giving a single call, a short trilling "prrr," or, if the excitement is greater, a higher-pitched "chwee." He appears a stocky, bull-necked little bird, with a plump white body, black skull-cap, wings and tail, and conspicuous orange feet.

But when he starts to display, his whole appearance alters. He stretches out his neck, sleeks his body plumage, and the elongated feathers of his throat shoot forward into a "beard" which at its fullest extension projects well forward of the tip of the beak. As he perches, tensed, horizontally across one of the saplings above his court, he reminds one strongly of a little white-bearded gnome. Then the display starts.



The Black-and-white Manakin perches, body tensed, beard extended, and looks at his court.

With a loud snap, like a percussion cap exploding, he jumps across to another of the perches round his court. As he lands he instantly turns to face the way from which he came; then with another "snap" he leaps back again. Backward and forward he goes for up to a dozen jumps, sometimes varying the procedure by making the rounds of several perches. After a while his eagerness appears to increase. With a "snap," he jumps to a position low down on a favorite sapling growing near his court. With beard fully extended, body tensed and quivering slightly, he looks down at some point on the cleared court a few inches away from him. After a second or two, with a "snap" he jumps down, as if catapulted, to this point which he has been eyeing, but no sooner has he touched the ground than he ricochets up with a loud buzz and alights on another perch on the other side of the court. Back he may go at once to the first perch to repeat the performance, and so it may go on for several seconds — "snap, buzz; snap, buzz; snap, buzz . . ." — so fast that he seems to be bouncing and exploding like a firecracker. When several males are performing thus, within a few yards of each other, others are doing back-and-forth jumps, accompanied by "snaps," and yet others, though not actively performing, are cheeping loudly and excitedly. The scene is bewildering in its animation and apparent

confusion, and the noise may be heard many yards off.

Females only occasionally visited the display grounds while I was watching. Their arrival was usually followed by an outburst of display, but I saw no response on their part. Dr. Frank M. Chapman described how, in the closely related Gould's Manakin (*Manacus vitellinus*), receptive females, after a brief mutual display, may either mate with a male in his court or fly with him into the forest.

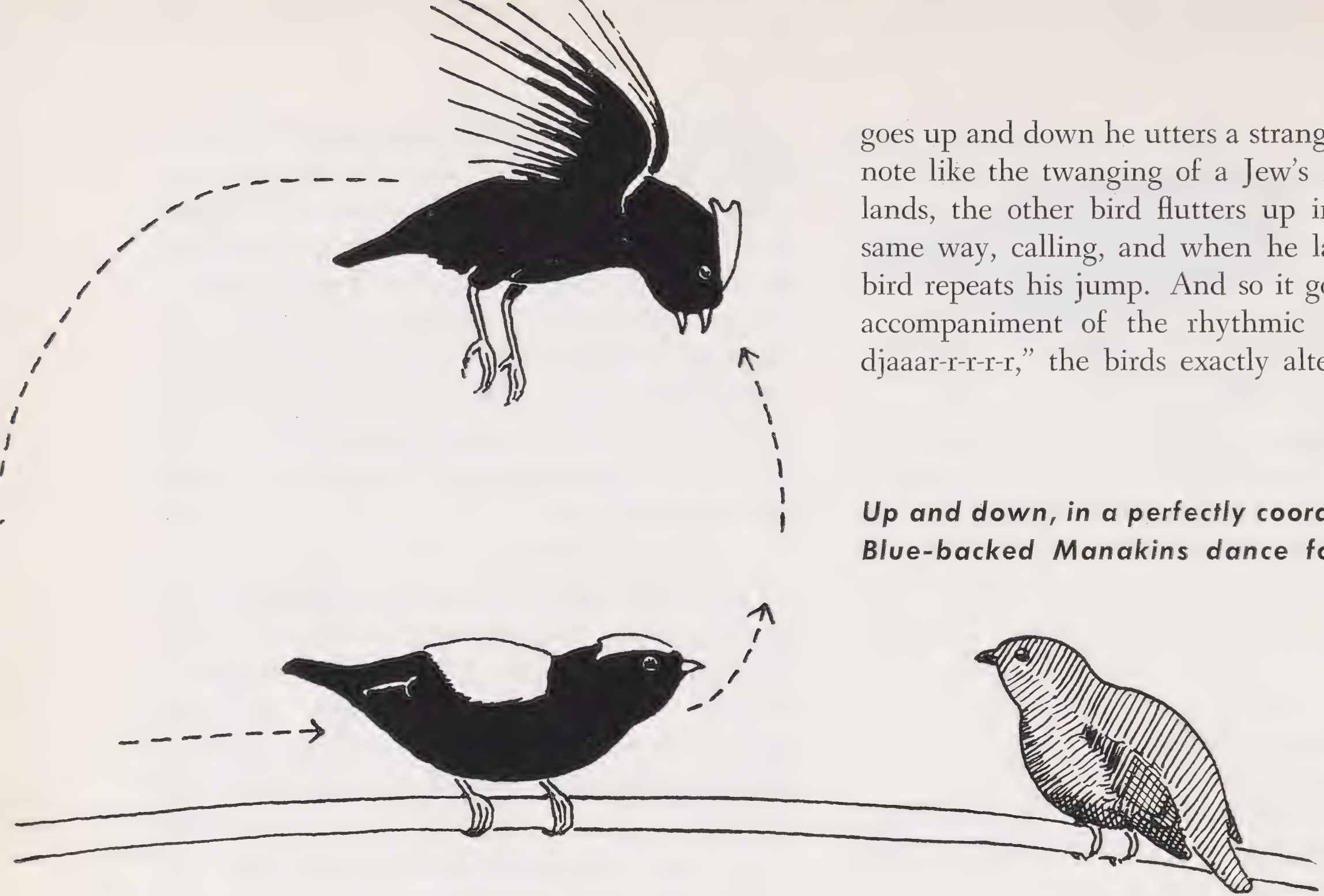
* * *

I found the beautiful Blue-backed Manakin to be common in the forest on top of Pigeon Peak, the high northern end of the Central Ridge of Tobago. In this species the male is, as usual, largely velvety black; with a triangular skull-cap of elongated crimson feathers lying flat on the top of his head, a patch of pale sky-blue silky feathers on the upper back, and orange legs and feet. The female, as in other manakins, is olive-green.

In one respect the Blue-backed Manakin is intermediate between the two Trinidad species — it gives its advertising calls from 30 or 40 feet up in the lower part of the canopy (which in these hill forests is not high), at the height at which the Golden-headed Manakin displays, while it has its display perches down near the forest floor, like the Black-and-white Manakin. In its social organization, however, it is unlike them, and probably unique. The males are in pairs. Pairs of males appear to occupy fixed territories in the forest; they spend much of their time together, and in particular nearly all their displays are performed jointly. On the first day when I went up Pigeon Peak to look for these



Two male Blue-backed Manakins sit side-by-side and utter their notes in unison.



goes up and down he utters a strange low vibrant note like the twanging of a Jew's Harp. As he lands, the other bird flutters up in exactly the same way, calling, and when he lands the first bird repeats his jump. And so it goes on, to the accompaniment of the rhythmic "djaaar-r-r-r-r, djaaar-r-r-r-r," the birds exactly alternating their

Up and down, in a perfectly coordinated duet, Blue-backed Manakins dance for a female.

manakins, I soon heard a loud insistent call, new to me, coming from the canopy. When I had located the source of the sound, I found not one but two males, sitting side by side, almost touching one another, their beaks opening and closing exactly at the same moment as they called a loud "quoip-quoip-quoip, quoip-quoip-quoip . . ." usually in groups of three notes, a sound like two ringing pebbles being struck sharply together. Later I heard and watched this call being uttered many times, and always it was by two males sitting together. When they are separated from one another they have two other different calls, with which they regain contact; it was never until they had come up close to each other that these contact calls gave place to the ringing "quoip-quoip-quoip, quoip-quoip-quoip."

After calling thus, often for many minutes, the pair of males may come down to their display perch. This they do in a series of short flights, each flight beginning with a soft click which is probably made by the wing-feathers in the same way as the much louder snap of the Black-and-white Manakin. Arrived at the display perch, a horizontal smooth twig two or three feet above the ground, the pair begin an alternating, rhythmic dance. First one bird flutters up to a height of about eighteen inches, hovers momentarily and then descends slowly to the perch. As he

buoyant jumps. Sometimes they go up and down in one spot, sometimes they jump over each other. Finally the dance ceases and, again with soft clicks each time they take off, they fly off by short stages.

On a few occasions I saw females come to the display perches. Their arrival always stimulated the pair of males to persistent dancing. Mostly they jumped up and down on either side of her, but I watched one pair perform a joint dance in front of the female that was so perfectly co-ordinated that I feel sure that it must be of regular occurrence. After the two males had jumped up and down several times on either side of the female, one of them jumped over her and landed by the other male. Then both males faced her; the male nearest the female jumped up and hovering in the air a foot or so up, moved slowly backwards, to land behind the other male which had meanwhile hopped up to take his place. Thus their positions were reversed. As the first male landed, the second jumped up and moved backwards in the air in the same way. So the circular dance continued, the two males moving so exactly in time that they seemed to form a catherine wheel revolving before the passive female. Soon the female, who did not seem impressed, flew off and the display broke up.

Extraordinary and diverse as are these dis-

plays, they do not begin to exhaust the variety to be found within the family of manakins. Few species have yet been studied, and there is no reason to suppose that those that have not been studied will prove any less interesting. Great diversity may be found even among closely related forms. Dr. Chapman described how Gould's Manakin, a near relative of the Black-and-white, adopts a "dirigible" pose, pressing its beak to the top of a broken off sapling and hovering in this position with its body held out horizontally like a moored airship; after which it may slide down to the ground, with its beak still touching the sapling and its body still in the "dirigible" posi-

tion. Other naturalists have reported that manakins differing only rather slightly from the Tobago bird have a communal dance in which several males take part, while one male, the "master of ceremonies," stands a little apart and by means of a special call gives the signals for the dances to start and stop, which the dancing birds rigidly obey. And still other rituals have been described. In the comparative study of the evolution of courtship, which in recent years has made such strides forward, the manakins offer a new and exciting field for investigation; they can be guaranteed to provide astonishment for the observer and surprises for the theoretical biologist.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Donald T. Carlisle

Donald T. Carlisle, known to many of our members through his membership activities in recent years, died on April 5. The Society's sense of loss was expressed in the following resolution passed by the Executive Committee:

WHEREAS, Donald Carlisle entered the service of the Society as a Vice President in 1945 and over a period of eleven years contributed his unusual talents to its purposes, and

WHEREAS, Donald Carlisle, with great understanding and affection for animal life, devised various means of interpreting the objectives of the Society to large numbers of people, and

WHEREAS, with charm, wit and artistry he was successful in building up and greatly stimulating public interest in the activities of the Society and thus substantially increasing the numbers of members and contributors to the Society, and

WHEREAS, his work for the success of the Society's activities will be of permanent value to it in the future,

NOW, THEREFORE, BE IT

RESOLVED that the death of Donald Carlisle is hereby recorded with a great sense of loss both from the point of view of his many admiring

friends and associates within the organization of the Society and also because, through his passing, the Society has lost the services of a man of rare gifts and character.

Duck-bills on Exhibition

Cecil and Penelope, the Duck-billed Platypuses, were taken out of their winter quarters in the basement of the Bird House and returned to exhibition in the out-of-doors Platypusary on May 11. Cecil weighed 3.828 pounds last October 29, when they were taken indoors for the winter, and 3.125 pounds on May 11 — a loss of .693 of a pound. Penelope dropped from 1.848 to 1.606 pounds in the same period, a loss of .242 of a pound. The Duck-bills came to us from Australia on April 25, 1947, and thus are now in their tenth year. No signs of breeding activity have been noted. They will be exhibited daily from 2 to 4 P.M.

King Cobras Try Again

Last spring our King Cobras mated and produced 41 eggs, nine of which eventually hatched — the first mating, laying and hatching recorded for this species in captivity. Mating was again

observed in late winter of this year, and on April 24 the female deposited 51 eggs, most of which were removed from her bamboo-leaf nest for incubation under controlled conditions of temperature and humidity. For some reason that is not clear, the eggs began to "go bad" almost immediately, and at the time of going to press only one egg remained with the appearance of viability.

"Inexplicable" Behavior on the Pony Track

As a rule, no animals are steadier and better behaved than the ponies that carry children around our riding track; they are accustomed by long habit to their plodding routine and "revolt" is all but unthinkable.

On an April morning they revolted.

One after another, as they started on their morning warm-up rounds of the track, they came to the descent from the bridge that spans the entrance to the Children's Zoo, and there they balked. With much urging one or two were induced to make one complete circuit, but on the second round they positively refused to proceed beyond the top of the bridge.

Such a thing had never happened before and it was supposed that something in the vicinity of the bridge was new and frightening. The Electrical Department's truck was standing alongside the track, and while it should have been familiar to the ponies it might be the cause of their alarm. It was moved away, but the ponies still balked. A ladder was leaning against a tree and the electrician was preparing to climb and connect wires to one of the exhibits in the Children's Zoo. The ladder was taken away — still the cause of the balking was unexplained.

At that moment the electrician bent to pick up tools on the ground, and let out a startled yell. He had received a tingling shock from the ground.

The mystery was explained. Underground cables supply some of the current to the Children's Zoo and over the years the conduit had rusted through, so that the ground was charged. The ponyboys, with their heavy and dry leather shoes, had not felt the current, nor had the electrician until he touched the ground. But the ponies had.

The current was immediately cut off and the underground line has since been repaired.

Bargains in Books

In our stockroom at the Zoological Park we have a few hundred copies of "The American Bison" by Martin S. Garretson and "Tropical Wild Life In British Guiana" by Dr. William Beebe, G. Inness Hartley and Paul G. Howes — the former published by the Society in 1938 and the latter in 1917 when our Department of Tropical Research was working at Kartabo in British Guiana. Now we need the shelf-space and the books are offered for clearance at \$1.10 each by mail, or \$1.00 if you pick up a copy at the Zoo.

IN BRIEF

Members' Tours. The Saturday morning tours of the Zoo for Members of the Zoological Society, which we announced in the last issue of *ANIMAL KINGDOM*, will continue indefinitely. The meeting place is the Members' Room in the Administration Building at 11 o'clock each Saturday morning, and the Curator in charge will lead the group on a tour until 12 o'clock. No advance arrangements need be made — the only requirement is to be on hand promptly, for once a tour starts it is difficult for late-comers to catch up.

Agile Jo. Some weeks ago our four young Chimpanzees, Amy, Jo, Beth and Meg ("The Little Women") learned what at the time was considered an amusing trick of climbing the vertical walls of their compartment in the Great Apes House. The walls are tiled and slick, but at the corners where two walls come together in



a right angle, the young Chimpanzees learned that by pressing against each wall with hands and feet, they could "hitch-and-hike" themselves up without difficulty. The trick had no significance until they were allowed out of doors this spring. Then Jo, always adventurous, found that she could wade the shallow moat and climb the outside wall at one corner just as easily as she could scale the walls indoors. She never attempted to go beyond the coping of the wall, and her exploit has been immensely popular with visitors, but it is not a spectacle we want to encourage. So temporarily the Little Women are confined inside the building while we figure out a way of keeping them from climbing out.

Grants for Holothurin. In 1952 the Aquarium's Pathologist, Dr. Ross F. Nigrelli, isolated from the Sea Cucumber a substance called Holothurin which is the first powerful antibiotic from a marine organism that has demonstrated anti-tumor effects. Now the Society has received a grant from the Damon Runyon Memorial Fund for Cancer Research, Inc., to enable him to continue his work with Holothurin, and the National Science Foundation has made a grant jointly to the Society and to Mt. Sinai Hospital to further chemical analyses of the substance. Dr. Nigrelli has been interested in the Sea Cucumber for many years, working on it at the Lerner Marine Laboratory in Bimini and in New York, and his first report of isolating Holothurin was made in our technical journal, *ZOOLOGICA*, in the spring of 1952.

Zoo Gate. The great bronze gate of the Zoological Park on Pelham Parkway — the gate presented by Mrs. Grace Rainey Rogers as a memorial to her brother, Paul J. Rainey, and designed by Paul Manship — is reproduced in color on the cover of the current issue of the Bronx Telephone Directory.

The Questions People Ask! Some of the inquiries directed to the attendants at the Question House recently:

"What are some of the fallacies about snakes that are true?"

"Is it true that the Hyaena changes sex, and that's why it's always laughing?"

"Is it true that if you spit in a snake's eye it will go away?"

"What are Ostrich eggs good for?"

Still Useful. When Charles Cordier brought us specimens of the Congo Peacock from the Belgian Congo in 1949, many natural history museums registered requests for the remains of these rare birds when they died. One male was found dead this spring — leaving two males in apparently excellent health — and it has been sent to the United States National Museum in Washington, where it is the third representative of the species in the collection.

Dolly and the Bobby-pin. When an Elephant develops a limp, it might be for any one of a dozen reasons. One of the least likely was responsible for a pronounced limp in the foreleg of Dolly, one of our Asiatic Elephants, late in April. Dolly had a bobby-pin embedded in her foot.

Saturday morning sheep-shearing at the Farm-in-the-Zoo is one of the most popular attractions for city-dwellers. Farmer Jim Coder shears one sheep each week and many people ask for bits of wool as a souvenir. The Farm's dog is always a watcher.





Presumably a visitor had dropped it and it had somehow gotten onto the floor of Dolly's compartment, perhaps being held upright in her food. Keeper Richard Herdick pulled the pin out with a pair of pliers, Dolly got an injection of anti-tetanus serum, and the incident appears to be closed.



Those "Baby" Otters. So rapidly do Florida Otters grow that the four babies born in early January are now almost as large as their mother and will soon be indistinguishable as youngsters. They are living up to otter reputation by being playful and inquisitive. They are still a little shy, however, even of Keeper Nesor who brings them their daily ration of fish. Recently the

Our two Komodo Monitors were off exhibition for several weeks during the winter while the interior of their Reptile House compartment was being remodelled. When the time came to move them from their temporary quarters in the hall to their permanent home — a distance of a few yards — the change was made swiftly and smoothly by holding an egg in front of each lizard. Pursuing the egg, they walked out, around two corners, and into their new compartment where Headkeeper Steve Spencook gave them a welcome. No difficulty.



Wildfowl Pond Reconstruction Is Nearly Complete

Except for seeding of the banks with grass and some additional planting of flowering shrubs and trees, reconstruction of the Wildfowl Pond is nearly complete. The pond has been much reduced in area and a low stone wall now gives it a new contour, with the entire water area on a con-



THE WILDFOWL POND AS IT WAS (LEFT) AND AS IT IS BEING MADE OVER

keeper has made a habit of laying out the morning's feeding of fish on the edge of the moat and tempting the female to approach and get it. One after another she picks up the fish and carries them a few feet to her eager but timid babies, feeding each one in turn. After the babies are fed she takes her own meal. The male, outlawed from the rest of the family by the aggressive female, remains so much in the background during the feeding that the keeper has to carry his fish to him at the far side of the enclosure. Even so, one of the bold babies has been seen to raid his father's meal and steal fish from him, without being punished. The male is, it seems, thoroughly cowed and overawed by his family.

Keas Again. Negotiations begun early in 1955 with the Wellington Zoological Gardens in New Zealand culminated this spring in the arrival of two Keas, members of the parrot family which have not been represented in our collection since 1951. One of these, "Old Shep," a favorite with visitors and keepers, lived for almost 29 years. The only distressing incident in his life occurred

crete bottom. By making it over in this way, so we can control the clearness of the water, we hope to avoid the outbreaks of botulism that have periodically attacked the wild duck population of the pond in hot summer weather. We cannot, of course, prevent wild ducks from flying in and bringing botulism they have acquired outside the Park, but the clear and clean water should materially reduce the incidence of the disease.

in 1940 when, after years of celibacy, he was given a mate. He had been accustomed to sleep in a hollow log in his out-of-doors compartment, and the log was immediately taken over by the new female, named "Phyllis," who refused to allow Shep to share it with her. When cold weather came and Shep had shivered for a few nights in the open while Phyllis slept snugly inside the log, we recognized his plight and settled matters by providing twin logs.

Best Show in the Zoo. When a baby White-handed Gibbon reaches the stage in his development in which he is able to make short excursions away from his mother, but is not yet completely on his own, we can unhesitatingly answer inquiries as to "the best show in the Zoo." This is it — and that is the stage our gibbon baby has now attained. A good part of the time the youngster clings to his mother's body and is a barely distinguishable ball of fur as she swings in long arcs on the exercise bars in her compartment in the Great Apes House. But at increasingly frequent intervals, as if by design, the female hudd-

dles quietly beside a coarse wire screen installed for the very purpose of giving the baby a place to climb. Junior scrambles onto the wire without urging, fumbles uncertainly for hand-holds and foot-holds, and climbs jerkily and uncertainly sometimes for as much as a foot before his mother's arm draws him gently back. If he seems in the slightest danger of falling, his mother's hand is instantly under him to steady him — and all done with an air of being preoccupied with other matters. Junior's older brother has become an accomplished performer on the bars and has learned a trick of swinging, jumping against the wall of his compartment, and bounding back to the bars. The family spectacle can be observed close at hand in the Great Apes House for only a little time longer, for the family will be removed to Gibbon Island in Lake Agassiz early in June, as soon as the weather is definitely settled and warm enough. By mid-summer the baby should be large enough and strong enough to make small journeys through the trees by himself.

THE MORNING'S MAIL

A Profitable Visit

SIRS:

The writer of this letter recently had reason to have a memorable moment of satisfaction for a goodly number of years' belief in the Way It's Done, as well as what the Zoological Society believes in on the grander scale, of adult education.

A small five-year-old boy had an ambition filled by going to the Bronx Zoo with his Dad (myself) on a very crowded day. The small boy's ambition had reached its height as we went into the new Reptile House. The crowd was just as stifling as it used to be in the old days when it smelled like "the Snakehouse at the Zoo," but somehow the small boy attached himself to Keeper Spencook, and the latter responded in turn. Keeper Spencook gave my small boy a complete tour of his own of the Reptile House, in a boy's own language, and at the same time added much informative comment that greatly interested the small boy's father. Both of us profited in our own ways from the Keeper's kindness and interest.

Three cheers for Head-keeper Spencook, and for a Zoological Society that fosters this kind of public relations, to say nothing of education.

RICHARD B. DOMINICK, M.D.

New Members of the New York Zoological Society

(Between March 1 and April 30, 1956)

Life

Mrs. Edgar S. Auchincloss
Henry Berol

Contributing

P. N. S. Abreu
Alfred Reginald Allen
Mrs. Frederick L. Allen
Dr. Alvan L. Barach
Charles M. Bernuth
Hilton R. Campbell
Mrs. Alfred W. Dater
Donald D. Dodge
Julian Gladstone
Mrs. Cyrus S. Grossman
Henry J. Heinz, II
Mrs. Henry J. Heinz, II
Al Katz
Mrs. Richard Peabody Kent
Joseph N. Kessler
Prof. Charles Glen King
Mrs. Emil Kratovil
John H. Livingston
William H. Meeder, Jr.
Mrs. Eleanor M. Mellon
Charles W. Nichols, Jr.
L. Douglas Pollard
William G. Post
Mrs. Salvador Ros
William R. Saner
Henry F. Sears, Jr.

Victor J. Sudman
Arthur Van Raalte
Mrs. J. G. Wentink
Gerald Whitman
Orme Wilson

Annual

William H. Addison
Charles Allen, Jr.
Joseph Mitchell Aronow
Dr. Elisha Atkins
Mrs. George H. Bissell
Mrs. William H. Bloom
T. G. P. Cann
Fairbank Carpenter
Mrs. Lowell R. Comfort
Miss May Del Rio
Mrs. Howard Dietz
Mrs. J. M. Ferrer
Miss Laura Fields
Master Michael Fox
John Gifford
Robert L. Goldsmith
Roy S. Gorman
Master Teddy Haendel
Arthur W. Hansen
Mrs. Duncan G. Harris
Miss Lorraine Jackson
Mrs. Adele Jacob
Mrs. Richard B. Julius
Mrs. John W. Keeshan

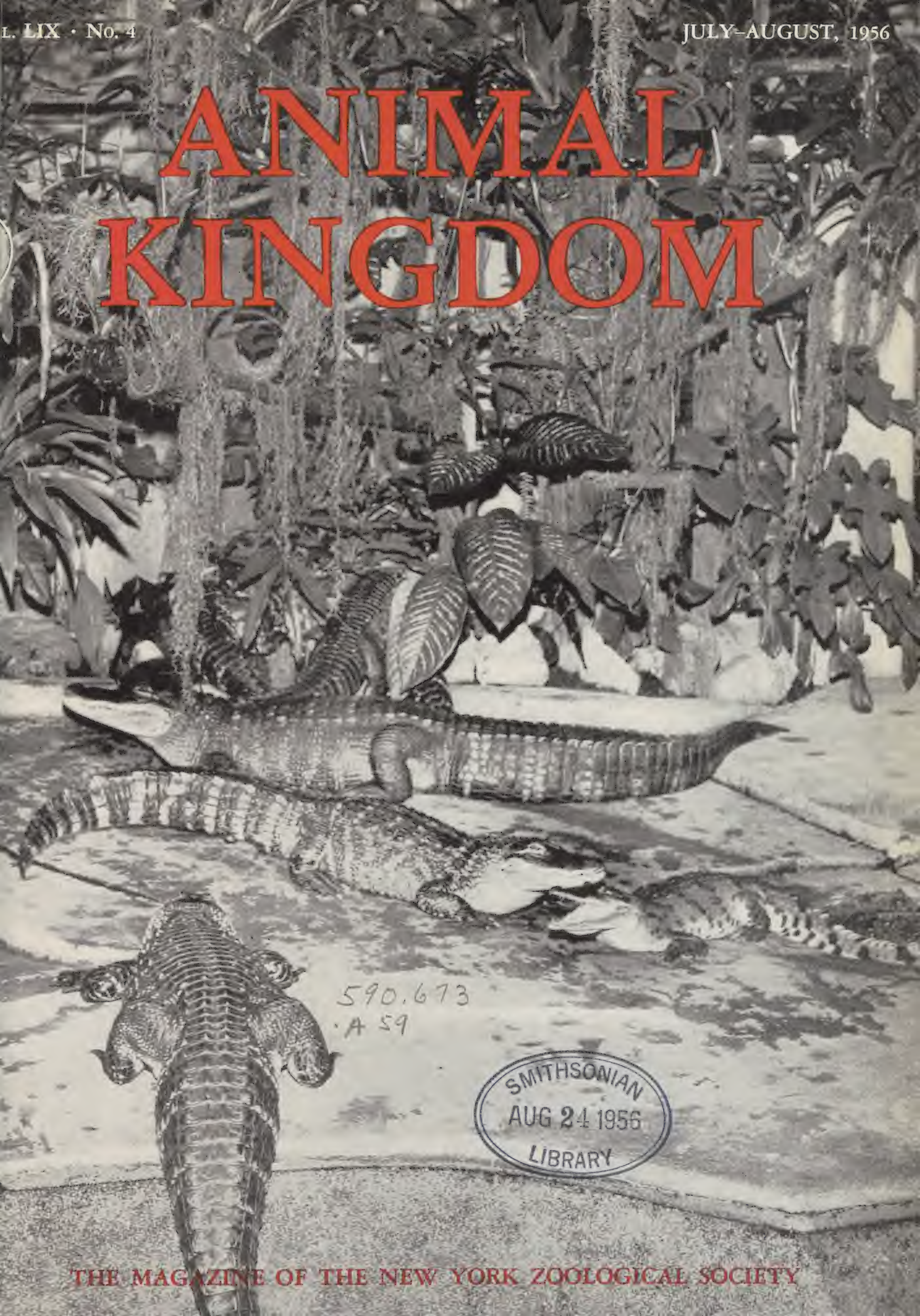
Mrs. Paul Killiam
Dr. Philip Knapp
Jerry L. Lichtman
Miss Rita Livingston
William D. Lucas
Mrs. Marie A. Mahoney
Mrs. Raymond K. Martin
Steve Mills
George A. Molleson
Mrs. Joanna J. Murphy
George P. Parker, Jr.
Mrs. Williamson Pell, Jr.
Edward J. Pelz
Mrs. Irving S. Pologe
Master Stephen Raphael
Miss Joan Redmond
John Roland
Dr. William Rowan
Dr. Henry Russell
Mrs. Max Schein
Mrs. Erika O. Schnell
Fred Herb Searl
Mrs. Edwin P. Shattuck
Mrs. Joseph Skopin
Daniel W. Stroock
Mrs. A. D. Turcas Throckmorton
Mrs. Robert T. Veit
Miss Jane Wasey
M. Woodbridge Williams
Guier Scott Wright, Jr.

A black and white illustration by C.B. depicting a scene in a rural setting. A woman, seen from the side, is wearing a sari and is leaning over a thatched roof. She is looking down at a book that is being held up to her by a man. The man is sitting on a simple wooden stool, wearing a light-colored shirt and trousers. He is looking towards the woman with a slight smile. On the thatched roof, there are two lizards. One is perched near the top, and the other is on the lower part of the thatch. The background shows some foliage and a simple structure. The artist's signature 'C.B.' is visible in the bottom left corner.

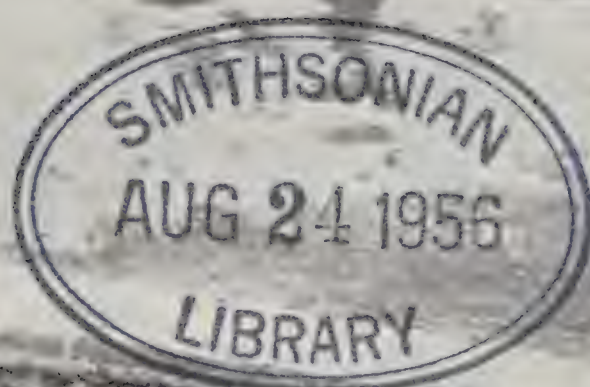
We can't call the way a gecko can, but we *can* urge you to chak chak the postcard opposite to call more members to the Society.



ANIMAL KINGDOM



590.673
A 59



NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT	VICE-PRESIDENTS	SECRETARY	TREASURER
Fairfield Osborn	Alfred Ely Laurance S. Rockefeller	Harold J. O'Connell	David H. McAlpin

EXECUTIVE COMMITTEE

Laurance S. Rockefeller
Chairman
George F. Baker, Jr.
John Elliott
Alfred Ely
Robert G. Goelet
De Forest Grant
David H. McAlpin
Robert Moses
Harold J. O'Connell
Fairfield Osborn
Edwin S. Webster, Jr.

Class of 1956
Archibald S. Alexander
A. Raymond Dochez
Robert G. Goelet
De Forest Grant
Eugene Holman
Warren Kinney
William De Forest Manice
Harold J. O'Connell
Landon K. Thorne
J. Watson Webb

BOARD OF TRUSTEES

Class of 1957
Robert E. Blum
Percy Chubb, 2nd
C. Suydam Cutting
Alfred Ely
Marshall Field
Childs Frick
Henry Clay Frick
David H. McAlpin
Richard C. Patterson, Jr.
John H. Phipps
Alfred G. Vanderbilt

Class of 1958
George F. Baker, Jr.
F. Trubee Davison
John Elliott
Robert I. Gannon
Peter Grimm
Fairfield Osborn
Eben Pyne
Laurance S. Rockefeller
John M. Schiff
Henry Sears
Edwin S. Webster, Jr.

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Grace Davall . . . *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandall *Associate Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch . . . *Assistant Curator, Education*
Quentin Melling Schubert *Superintendent,
Construction and Maintenance*
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. . . *Research Associate in Ichthyology*
Harry A. Charipper . . *Research Associate in Histology*
Homer W. Smith . . *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges . . . *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory
John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez
Alfred E. Emerson
W. A. Hagan
Caryl P. Haskins
K. S. Lashley
John S. Nicholas

AFFILIATES

C. R. Carpenter, *Co-ordinator
Animal Behavior Research Programs*
L. Floyd Clarke, *Curator
Jackson Hole Biological Research Station*

CONSERVATION FOUNDATION

Stephen W. Bergen
George E. Brewer, Jr.
John C. Gibbs
Samuel H. Ordway, Jr.
Hugh J. Ross
Robert G. Snider
Peter M. Stern

59D.673
A59

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

Swamp Scene in the Reptile
House *Sam Dunton* Cover

The American Beaver
Albert R. Shadle 98

The World's Only Venomous
Lizards
Charles M. Bogert 105

This "Kinkajou" Was Really
the Very Rare Olingo
Richard H. Manville 109

Zoo News in Pictures
Photos by Sam Dunton 112
England's "Rabbit Disease"
H. N. Southern 116

Our First Pileated
Woodpecker
Lee S. Crandall 123

News from the Conservation
Foundation 124

Behind the Scenes 125

Vol. LIX AUGUST 1956 No. 4

Issued bi-monthly at the Offices of
the New York Zoological Society,
30 East Fortieth Street, New York
16, N. Y. Editorial and Subscrip-
tion Offices, Zoological Park,
Bronx Park, New York 60, N. Y.
Title registered with United States
Patent Office • Subscription,
\$3.50 a year; single copy, 60 cents.
Same rates for all foreign coun-
tries and Canada. All pictures not
otherwise credited are from the
photographic collection of the
New York Zoological Society.

Time and Change

THE OTHER DAY a friend sent in a document that he had found while looking over some old family records. It was entitled, "Memorandum Regarding Zoological Park," and dated March 4, 1898, an exciting era in the history of our country. Three weeks before, the battleship *Maine* was blown up in Havana harbor and the following month we were at war with Spain. It is strange to recall that the infant days of our Society occurred in such a critical period.

This early document contains much interesting material, including the statement that "the purpose of the Zoological Society is to make of the Zoological Park an institution which will yield more pleasure and benefit to the great mass of the people of New York than is yielded by any other public institution in this city." That statement, made 58 years ago, continues to hold true.

The report also includes a "list of animal buildings and enclosures that must be provided this year and the utmost limit of cost for each." Our young Society was engaged in its first fund drive to bring the Zoological Park into existence. Some of the costs of the buildings are amazing to look at today and reveal the almost unbelievable changes in the economy of our country that have taken place in the last half century. For instance, the Reptile House was put in for a cost of \$25,000 although several years later, with amplified plans, its actual cost was twice that. Four years ago we modernized the interior of this selfsame building at an expense of almost five times its total original cost.

Several morals can be drawn from all of this. One of them is that the compulsion upon our Society to create ever better services to the public is unchanged. Our obligation is to complete the new Aquarium, to make constant improvements in the Zoo, to extend the work and influence of the Society in science, in conservation and in education. If the value of the dollar has declined, the value of the Society's work has increased far more. Only through the great generosity of all who believe this can our Society realize its immeasurable opportunities.

Fairfield Osborn

Architect,
Lumberjack

&

Conservationist



THE AMERICAN BEAVER

By ALBERT R. SHADLE

Biology Department, University of Buffalo

EDITOR'S NOTE: *This is the first of three articles by Dr. Shadle, Emeritus Professor of Biology at the University of Buffalo, on the American Beaver — a subject in which he has been interested for many years.*

AMONG THE MANY interesting mammals of North America, the Beaver can definitely be ranked first on various points. It is the only North American mammal that has the ability to construct lodges and dams, some of which attain really huge proportions compared to the size of the builder. Its ability to build and maintain canals and also its capacity to accomplish great amounts of actual physical work are phenomenal. As a fur bearer it is outstanding. For these and many other reasons, it has been, and continues to be a most fascinating animal to observe and study in its native habitat.

In the early days, the American Beaver, *Castor canadensis*, our largest North American rodent, weighing forty to sixty pounds or more, ranged over all of North America except the extreme northern and the extreme southern parts. Beavers occurred in large numbers over most of their northern range. The fur was soon in great de-

mand in Europe and in America, both for clothing and for the manufacture of unusually large, wide-brimmed, felt hats which were so popular from the sixteenth to the mid-nineteenth century. This felt was produced by a special process from the fur of the Beaver, and the hats were called "beavers" or "beaver hats."

At one time the Beaver skin was the unit of value in barter and the cost of various items was quoted in terms of skins of certain sizes. They became a kind of native money. The early missionaries were quite interested in the furs which the Indians collected, and again the Beaver pelts, because of their excellence, their value and the large numbers collected annually, were a great inducement both to missionary activities and to colonization of the North American hinterland. To a very large extent, the Beaver's life and pelt paid for these efforts and the animal was an important factor in some of the early strife involving much of the North American continent.

Over the years, the continued demands for Beaver skins, the settling of the wild regions and their development into farms and cities, gradually and sometimes completely exterminated the Beavers over wide areas. This continued until, at the

s a young Beaver floats in the edge of the pond, its small fore feet seize and manipulate its food. The hind feet, one of which is faintly visible under the water, are larger and quite broadly webbed.

Photo by R. D. Fraser

beginning of the twentieth century, many of our states no longer numbered the Beaver on their faunal lists. Eventually the Spirit of Conservation began to take root and grow in this country and at last our people began to realize that in many areas some of our finest game and fur animals were sadly depleted, if not completely exterminated.

the new conditions, many of their old enemies (Wolf, Fisher, Lynx, Wolverine, Bear and Otter) are either absent or occur in such small numbers that they do not offer much of a threat to their welfare. Even man, the Beaver's most insatiable destroyer, has to a large extent become its friend. Without natural controls on their increase, Beavers often multiply so rapidly that they overpopulate an area and destroy their own food supplies faster than normal growth can replace them. In such a situation State Conservation Departments must step in to manage and control the



In the efforts to reverse the downward trend of our fauna, the Beaver received considerable attention. Various states procured and "planted" Beavers in areas where they had once been common. With adequate refuges, wise management practices, stern, well-enforced laws for protection and adequate restrictions on trapping, the animals have made remarkable progress in repopulating their former range.

Today Beavers have practically as wide a distribution as in the early days, but they are generally not as numerous as they were then. Under

The dead trees surrounding this Beaver lodge were killed when the building of the animals' dam flooded the area. Trees killed by Beaver floods represent a minute proportion of losses from fire.

Photo by R. D. Fraser

Beaver population and keep it within the carrying capacity of the area.

THE BEAVER is usually spoken of as a semi-aquatic mammal, because it is always associated with wooded and brushy fresh-water areas such as swamps, streams, ponds and lakes. Woody plants and fresh water are absolutely essential to



the life of the Beaver, for the bark and leaves of several trees and shrubs form its main diet, and the wood serves for its construction work. The wide area of water around its home is protection, transportation, playground, air conditioning of the living quarters and cold storage for the Beaver's winter food supply.

To appreciate the things that Beavers can do, it is necessary to understand some of their remarkable adaptations to a semi-aquatic life. When you see a Beaver on land it is a stocky, lubberly, awkward animal, but let it get into the water and you will be amazed how active and graceful it is, and how well-adapted to that element. It swims rapidly, dives perfectly and is such a powerful swimmer that it can tow a heavy load for long distances by seizing it with its very large incisors and drawing the load along beside it as it swims.

The hind feet are large, broadly webbed, and

are actuated by heavy, muscular hind limbs and lower back. Through this powerful structural combination, the Beaver accomplishes a great deal of actual physical work, such as walking semi-erect, swimming, towing and carrying materials, and dragging wood cuttings over the tote roads or Beaver trails.

The fore feet remind one of little clawed hands, for they are only a fraction of the size of the hind feet, are extremely facile in seizing and holding things, and in gathering and manipulating food materials that are being eaten. They also serve in carrying and placing the materials used in building, and the handling of the young by the Beaver is in part done with these little fore feet.

In spite of doing much work in mud and water and living in a house built of mud and sticks, the Beaver is a very clean, neat animal. All urine and fecal material are discharged in the water

and are very seldom seen around the colony. The Beaver's fore limbs and paws are used like hands and arms to brush and press the excess water from its wet coat, thus hastening the drying process so that less water is carried into the sleeping area and onto the bedding. The Beaver spends considerable effort in the care of its coat. The feet, particularly the claws of the two inner toes of the hind feet, are used in combing and grooming the fur.

The whole skeleton and the muscular structure are very strongly built and the animal demonstrates great power in lifting, pulling, pushing, swimming, and in any other muscular efforts in which it indulges.

An outstanding feature of the adult Beaver is the large, heavily-boned skull with its four orange-colored, long, curved, gnawing incisors which have sharp, chisel-shaped, cutting edges. The two lower ones are the longer, measuring from three to five inches in length, and extending from the front of the lower jaw well back under the molars to a point near the base of the jaw. The strong jaws and cutting teeth are operated by such powerful muscles that Beavers can cut down growing

A man eating an ear of corn would hold his food just about the way this Beaver holds a tender twig. The animal's fore feet are perfectly adapted for holding and turning while the incisors strip the bark.

Photo by Anita Este from National Audubon Society

trees which may be as large or larger in diameter than a man's body.

The animal's orange-colored incisors grow in length throughout life and the Beaver must keep them sharp and must not permit them to grow too long, lest they become misshapen and useless. The hard enamel of the incisors covers the front portion of the structures, but the main bulk of the teeth is composed of a bone-like substance called dentine, which is not as hard as the enamel. The difference in the hardness of these substances enables the Beaver to keep the tips of its incisors chisel-shaped and sharp. The hard enamel of the lower incisors cuts away the dentine behind the enamel of the corresponding upper incisors, leaving the upper enamel sharp-edged. By pushing the lower jaw slightly forward, the Beaver can bring the upper incisors into position behind the lower ones so that it can cut away the dentine of

these, leaving the enamel of each lower incisor with a sharp, chisel-shaped edge. Thus the trimming of one pair of incisors by the cutting action of the opposite pair keeps all four at proper length and in good functional condition for gnawing.

The hardness of the food and building materials which these animals gnaw has little to do with the wear or attrition of the incisors and the sharpening and shaping of their cutting edges. It is the trimming of one pair of incisors by the other pair which is the important factor. This condition has been well demonstrated to me by my pet Beavers in my laboratory.

The longer lower incisors do by far the greater part of the wood cutting, while the sharp tips of the upper ones act largely as anchor points against which the lower ones swing in their cutting action. The heavy molars grind the bark, twigs, leaves, etc., to a fine pulp which is thoroughly mixed with saliva before the soft and bitter mass is swallowed.

The nostrils of the Beaver contain a little flap-like valve which closes automatically whenever the animal dives or submerges its head, and thus the water is kept from getting into its nostrils and into the lungs. The lungs have quite a capacity for reserve air and this enables the animal to stay under water for as long as fifteen minutes at a time. This is a great advantage when it has to dive and swim for a long distance to escape an enemy, or when it is swimming below the water surface, or under the ice in the winter.

The sense of smell seems to be rather keen and the Beaver makes frequent olfactory tests of substances which it is eating. It is a common occurrence to see one pick up a twig or other bit of food and hold it up to the nostrils to test it before starting to eat.

The ears are small and rather rounded and so filled with short, fine, oily hairs that the water does not penetrate the external ear cavity when the Beaver's head is under water. Like the nostrils, the ears can be closed when the animal submerges.

The tail is a very characteristic appendage which serves several functions. It is a short, broadly flattened, paddle-shaped structure which is well covered with large scales, and is almost devoid of hairs except a few short, bristle-like ones along its edge and occasional ones found among



When a Beaver gives its warning signal to other members of the colony, it does so by hitting the water with a hard smack of the flat of its tail. The sound is loud, water splashes high.

the scales. The numbers of hairs on the tail vary with different individuals.

The length of the tail ranges from eight to twelve inches or more, the width from three and one-half to six inches, and the thickness varies from a quarter of an inch or more at the edge to more than two inches at the base. In walking, the heavy tail simply drags along and in the soft mud it makes a broad, flat, tail-mark. When swimming, the tail functions as a rudder modifying the direction of progress. To some extent it is also used in backing and shifting the position of the rear part of the body, and at times there seems to be a sort of sculling action. Sometimes the heavy tail functions as a counterbalance when the Beaver is carrying a load; for example, when swimming with a load of mud, etc., the big tail is often lifted and carried in a sharp-angled position so that much of it sticks out well above the water. If walking with a heavy load, the body is carried semi-erect on the hind feet and the tail, instead of dragging along behind, is sometimes

lifted at an angle which aids in counterbalancing the load.

When a Beaver is disturbed, it often warns the others in the colony with a heavy stroke of the tail. To do this, the tail is quickly lifted well above the water and brought sharply down upon the surface with a loud smack which splashes considerable water for several feet. Such a hard stroke of the tail often lifts the rear end of the animal somewhat out of the water, and simultaneously submerges its head. Thus a quick dive may be executed which takes the Beaver to safety. At close quarters, the tail is also used as a defensive weapon, and experience has taught me that it can deliver quite a strong blow.

When the mother is nursing her new-born kits, she frequently raises one hind foot and swings her thick, warm tail under her belly where the young crawl upon it and rest while nursing.

The fur is remarkably well-adapted to the Beaver's aquatic habits. It is composed of two main kinds of hairs. The dark, chestnut-brown outer guard hairs are rather coarse, and long enough to extend considerably beyond the soft, very fine, rich, dark-brown underfur which one sees in the finished Beaver furs, for all of the guard hairs are plucked out in the finishing

process. This underfur is so soft and fine and is kept so well-conditioned with oil that it is quite thoroughly waterproofed. A pair of large glands near the rectum secretes an oil which is distributed over the coat of the Beaver by the feet during the grooming action. When the animal plunges into the water and the long guard hairs become wet, they flatten down over the underfur, forming a sort of envelope or cover which aids materially in keeping this finer fur dry. Because of the guard hair cover and the oiliness of the fine fur, the Beaver can swim for long periods, or sit immersed in the water for half an hour or more while feeding, without getting the underfur and skin wet. This is particularly advantageous during the winter when the water is near freezing temperature.

When the Beaver comes out of the water and shakes itself, the long wet hairs clump together, but when they dry off they again separate and assume their furry appearance. The drying is hastened by the action of the feet in pressing the water out of the wet fur and also by a kind of combing action in rearranging the hair.

In the warmer southern part of the range of the Beaver, the fur has a lighter tone, is less rich in color, and its quality does not equal that of the northern Beavers of the colder regions.

On land, a Beaver usually walks along on all four feet with a slow, awkward gait. Approaching a tree which it is about to cut down, it examines and sniffs at it, and rearing its body so that it is supported on its big hind feet and the broad flat tail, it places one or both of its fore feet against the trunk. Turning its head sharply to one side, it uses its heavy incisors to cut loose the bark. If the tree is small and its bark soft enough to make good food, a hungry Beaver may cut loose a strip of the bark at the bottom and give it one or more hard jerks, tearing it free as high as it can. It then cuts the upper end of the strip free from the tree. Taking the strip in its fore paws and nipping the bark up into small bits, it chews them thoroughly and swallows them. It may continue to cut bark and feed until it has

A Beaver is an expert at felling trees of this size and even larger, but it has no control of the direction in which the tree falls. On rare occasions a falling tree may kill the animal.

Photo by R. D. Fraser

completely girdled the small tree or until its hunger is satisfied. It then starts to cut the wood.

In case the tree is a large one and the bark of the base is quite rough and corky, this tough hard layer is chipped away and the chips are allowed to fall at the base of the tree. Only the softest inner bark is used as food, or if the Beaver has previously fed to satiation, it may promptly start the process of felling the tree. Large mature Beavers weighing forty to sixty pounds can cut quite large chips when they are working on soft woods, such as aspens. These chips may be as much as two inches wide, more than a quarter of an inch thick, and as much as six inches or more long. The same Beavers when cutting quite hard woods, such as wild cherry, may be able to cut only small chips not much larger than the end of one's thumb.

The time that it takes a Beaver to fell a tree depends upon several factors; soft trees such as aspens, other poplars and willows cut easily and rapidly, while birch, shadbush, blue beech, sugar maple and wild cherry are much harder and heavier woods and are more difficult to cut. The diameter of the tree is another important factor, of course. If the Beaver is quite energetic, the need is urgent, and it sticks to its job, it will finish much sooner than when it works intermittently and dawdles around at the cutting, as sometimes happens. During harvest time, in late summer or early fall, the Beavers seem to put more effort and vigor into their felling of trees, but I have seen trees that were not felled for more than a year after cutting had started. Sometimes more



than one animal works at felling a particular tree and this too modifies the time involved.

If the Beaver can get completely around a tree, it will gnaw on all sides, cutting deeper and deeper towards the center until the weight of the tree on the weakened base causes the remaining wood to bend or break and the tree falls in whatever direction it was leaning. When the last wood fibers begin to snap and break as the tree starts to topple, the Beaver hurries away to safety. Beavers are almost never caught by falling trees, but there are a few known instances. It would be very interesting to know how the animal determines which way to go to escape a falling tree.

The direction of the fall is a matter of chance, depending upon several factors, and the Beaver has no ability to change the results. Among these factors are the size, the height, the direction in which the trunk is inclined, the direction and force of the wind, and the condition of the surrounding area, i.e., whether it is fairly open or thickly grown with other good-sized trees into which the cut tree may fall and lodge without reaching the ground. Such a lodged tree is usually a total loss, for Beavers can not climb trees. They can not reach and remove the limbs of the felled tree unless it has crashed to the ground.

I once found a tree that the Beavers had cut off twice. It had stood so straight that when it was cut off the first time, the lower end simply slipped off the stump, dropped straight down about fifteen inches and stuck in the ground. Leaning against the trees behind it, it stood there almost as straight as it had originally. The Beavers cut it through a second time, but once more it dropped straight down and leaned against the other trees. That was enough; the Beavers gave up the job and left it still standing there supported by its neighbors.

Once a tree crashes to the ground, the Beavers start to dismember it and transport the pieces to their working area. From a tall straight trunk, the upper smaller diameter may be cut into a twelve-foot section; the next section, larger in diameter, may be cut only seven feet long; the next one, four and one-half; and the last one, only thirty inches. A little pile of chips on the ground marks each point at which a section was cut off. Even when the sections have been taken away, you can get the approximate length of each

successive piece by measuring from the center of the chip pile at one end of the cutting, to the center of the next pile of chips at the other end of the cutting, and so on down the trunk.

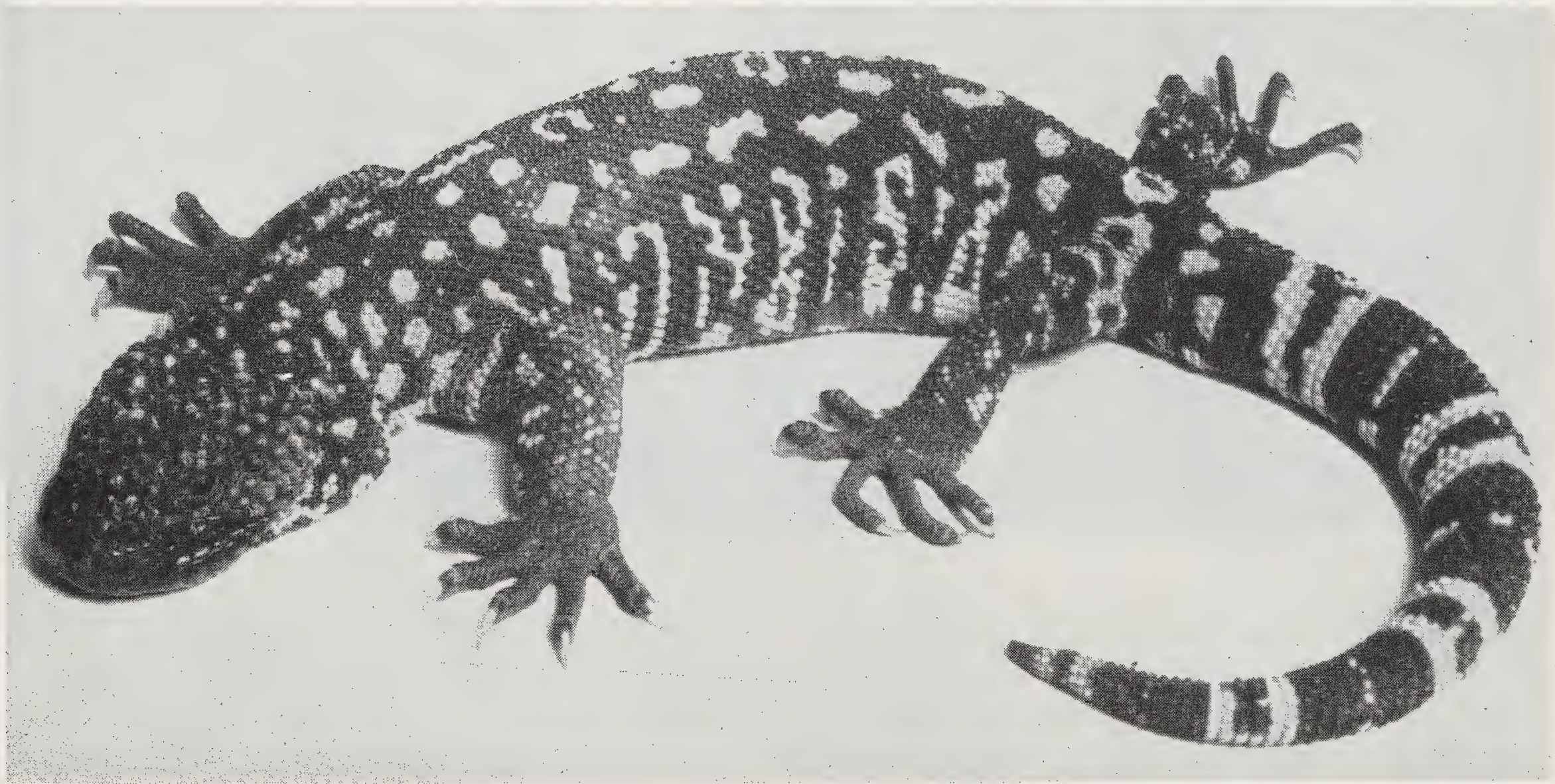
When the Beavers start to take away the branches and pieces cut from a felled tree, they usually take a fairly direct route back to the area where the material is to be used. If the ground is comparatively level and clear of plant growth, they can drag their cuttings over it rather easily, but when it is uneven, bushy, or grown with high grass and weeds, their first loads will be difficult to drag. When their materials catch on roots, shrubs, stubs, or bushes along the way, they often gnaw off and remove the bothersome objects. Each time they go over the new path, it becomes smoother, thus making travel easier. Long grass, repeatedly combed in one direction by the brush and limbs, is eventually swept flat and points in the direction of the drag. Such a transportation road or trail is called a "Beaver tote road." In dragging a limb, the Beaver, with its head bent to one side, seizes the limb at one end with its four large incisors and, walking on all four feet, drags the load along beside it.

Wet tote roads offer less resistance to the load than dry ones, and when the trail or path leads across a low, wet area, the Beavers dig, pull and push the mud and vegetation to one side, so that the water stands in the path, thus making the drawing of the loads easier at that point. Where there is a mere trickle of water, they try to store it up by digging away the soil and making little dams. These tote roads are so well marked that one can often learn from them a great deal about what the Beavers have been doing. Back-tracking on the trail, you can discover where they have been cutting, the number, the sizes, and the kinds of trees and bushes they have cut, whether or not they are still using the area, how many "waste trees" they felled, i.e., trees which were cut off but lodged among the standing ones and did not fall to the ground.

By following the tote road, you can also tell how far they have taken loads over land, where they took them into the water and, usually at no great distance, where the cuttings were taken, and how they were used. Often you can see the lodge and dams which are being built or repaired.

(To be continued)

The World's Only Venomous Lizards



The Mexican Beaded Lizard, a close relative of the Gila Monster, is larger than the "Monster" and is known as the "Escorpion." Its specific name, "horridum," indicates its reputation.

By CHARLES M. BOGERT
*Curator of Amphibians and Reptiles
American Museum of Natural History*

IF YOU HAVE EVER SEEN the Gila Monsters in the Bronx Zoo, you may have wondered why, if they are desert animals, they are soaking in the water of their quite large but shallow pool. Or you may have wondered why a lizard less than two feet in length is called a "monster."

To answer the first question we must know something of the lizard's habits and behavior. To reply to the second question we should know something of the lizard's anatomy and the myths, misinformation and folklore that came about as a result of it.

A lizard much like the Gila Monster lived in North America long before our ancestors could have been called human. A fragment of an upper jaw found in northeastern Colorado shows that a close relative, if not an actual ancestor of

the Gila Monster, was inhabiting that region more than thirty million years ago when the horse was just beginning to achieve its three-toed condition. If a recent report is substantiated, another relative of the Gila Monster inhabited western Europe at about the same time. The few fossils known show that these lizards may not have changed appreciably during the last twenty or thirty million years. They seem to have branched off the same stock that gave rise to the monitor lizards and the snakes. The early progenitor of the Gila Monster may have hastened for cover to avoid being stepped on by a clumsy dinosaur.

Today the beaded lizards, as the Gila Monster and its larger Mexican ally have come to be known, are largely restricted to the Pacific slopes



of North America. The Gila Monster in the United States is found only in extreme southwestern Utah, the adjacent parts of Nevada and southward along the edge of the Plateau through Arizona and southeastern New Mexico. It is found in the more arid portions of the Mexican state of Sonora, but where the vegetation of the tropics penetrates the southern portion of that state, the Gila Monster is replaced by the larger Mexican species known as the *Escorpión*. The range of the tropical species extends on down to the Pacific Coast to the Isthmus of Tehuantepec, well up into the foothills, but never crosses the continental divide until it reaches the state of Chiapas. Here it shuns the wet forests of the Atlantic drainage and stays within a narrow sub-arid "rain shadow."

Most other families of lizards enjoy a wider distribution, with numerous species often scattered over several continents. The beaded lizards, by comparison, have not fared so well. But the regions they inhabit extend some two thousand miles through arid tropical and desert vegetation — a fair share of the earth's surface for two species. Their long ancestry, together with their ability to hang onto this territory, shows conclusively that they are not ill-adapted for survival.

A Mexican Beaded Lizard of nearly the maximum size attained by the species is shown here in the San Antonio Zoo. This specimen weighed almost ten pounds and was nearly twenty inches long

Photo by the Author

We shall never know when the beaded lizards established their present mode of existence. But probably the lizard that inhabited eastern Colorado millions of years was thrusting out its forked tongue and crawling about in search of food in much the same fashion as the Gila Monster of today. Then as now the lizard's sense of smell was probably its most important asset in locating suitable food. Vision, unless far more perfected than it is in today's beaded lizards, would have been of little help in locating the eggs other reptiles had so carefully buried beneath the soil. We now know that beaded lizards use their protrusible forked tongue not merely to lap up liquids, but to carry odorous particles to special sense organs of smell in the roof of the mouth. Experiments show that Gila Monsters do not dig at random. Odors emanating from eggs buried in the ground enable them to select the exact spot where food will be found.

The sense of smell is also employed by the beaded lizards in locating the eggs or fledglings of

ground nesting birds, of Quail in particular. Similarly they prey upon nestling Rabbits, Round-tailed Ground Squirrels, and Cotton Rats. Adult rodents are doubtless too fast for the clumsy Gila Monster to pursue, however, for its maximum speed is scarcely eight-tenths of a mile per hour.

An *Escorpión* taken near Tehuantepec had consumed thirty-five leathery-shelled, inch-long eggs of some lizard. Farther up the coast, in the state of Michoacán, an *Escorpión* had evidently raided the nest of a mud turtle just as the eggs were about to hatch. It seems to make little difference to the beaded lizards whether the eggs have been freshly laid or are well along in their incubation. Whenever possible eggs are swallowed whole, whether they are leathery-shelled, or hard-shelled like those of birds and of some turtles.

The Gila Monster and the *Escorpión* are perhaps most aptly described as nest robbers. But occasionally they prey upon smaller lizards, digging them from their places of seclusion during the hours of darkness. Such desert dwellers as the Whiptailed Lizard (*Cnemidophorus*) and Collared Lizard (*Crotaphytus*) are unable to move with any speed until by basking they have raised their temperatures to levels corresponding roughly to those of man. Gila Monsters, which are normally active at body temperatures between 75 and 88 degrees Fahrenheit, take advantage of their lower heat requirements. Whiptails and Collared Lizards, too cold to protect themselves,

readily fall victim to the relatively cold-tolerant Gila Monster.

"Why," you may well ask, "is a cold-tolerant lizard an inhabitant of the desert?" The answer is far from obvious, but it seems probable that the Gila Monster was living in the region it now occupies before it was a desert. As the region became increasingly hotter and drier the Gila Monster modified its habits. In many respects this lizard does not seem to belong in the desert. A Gila Monster exposed to the sun on a warm day in the desert was paralyzed within thirteen minutes. But had the poor creature been left to its own devices it would have been safely hidden in a cool, moist burrow.

This brings us to our first question, "Why do these desert lizards seek water in captivity?" Gila Monsters are commonly seen abroad following or during summer rains. To avoid desiccation they go underground during dry seasons. Except in the cool months of early spring, when they are active during the day, they come out at night or when the sky is overcast and temperatures are lower and relative humidities are higher. If they are provided with moist sand in captivity they burrow into it. If no sand is available they do the next best thing and sit in the water provided.

Almost its only conspicuous adaptation for survival in the desert lies in the Gila Monster's tail. During periods of heat and drought when food is scanty the tail becomes thin and emaciated. But when food is plentiful the excess fat

A young Gila Monster (this one probably less than a year old) has well-defined bands on the tail. As it matures, scales in the black areas change to pinkish, while others in the light areas turn black. This odd reversal gives the adults a more complex pattern than that of a juvenile.

Photo by George M. Bradt



produced is stored in the tail, which may almost double in diameter. When it is either too hot or too cold, or if there is a prolonged drought, the Gila Monster can remain quietly in its moisture-conserving burrow, drawing upon the stored fat to maintain life until the advent of food and moisture on the surface.

Like the skunk and the porcupine, the beaded lizards are slow because they can afford to be. No premium has been placed on speed in their struggle for survival, because they have other means of defense. The upper surfaces of the body, including the limbs and the head, are protected by bony plates or osteoderms imbedded in the skin. As though this armor were not enough, the beaded lizards, alone among the thousands that evolved from the ancestral lizard, have gone on to acquire a venom apparatus. Compared with that of the vipers and the cobras it is crude. For unlike all snakes, the beaded lizards have their venom glands in the lower jaw rather than the upper. Three or four ducts lead from a gland on each side of the lower jaw and discharge the venom near the bases of deeply grooved teeth provided with sharp cutting edges.

When a Gila Monster or an *Escorpión* bites it hangs on with unbelievable force. The venom is not driven in under pressure, however, as it is with the more specialized snakes. It is merely drawn into the wound by capillary action. Virtually all the teeth in both jaws are grooved to some extent, and the angry hissing of an infuriated lizard may well carry the venom throughout the mouth. Human beings nipped by the small, shallowly grooved teeth at the front of the jaw have been painfully reminded that they are dealing with a venomous reptile.

Snakes employ their fangs as an efficient means of subduing their prey. In contrast the beaded lizards ordinarily gulp down small animals after killing them by the crushing action of their jaws, without waiting for the venom to take effect. It would seem, therefore, that the crude venom apparatus of the lizards evolved solely as a means of defense. If we may judge by the three teeth in the jaw fragment found in Colorado, the venom apparatus has undergone little change during the last several million years that it has served as a protective device.

The venom is more potent than that of many

snakes. One-tenth of a cubic centimeter of fresh venom is sufficient to kill a dog weighing twenty-two pounds. This means that a large Gila Monster has enough venom in its glands at one time to kill twenty dogs, but only, of course, if it were injected into their blood stream.

It has been questioned whether a Gila Monster could inject enough venom into a human being to cause death. However, Mme. Marie Phisalix, who was herself bitten by a Gila Monster, became convinced that it took much less venom to kill a human being than it did to kill a dog. At least four persons have died shortly after being bitten, and extremely painful and often severe symptoms have resulted from bites inflicted on other individuals.

The venom is largely neurotoxic. That is to say, it affects the nerves, causing excruciating pain, numbness, hypersecretion of the glands, and in severe cases the central nervous system is impaired, with death resulting from respiratory failure. While many snakes strike from a coiled position, driving their fangs into the flesh of the victim by a stabbing action, the beaded lizards must depend upon their ability to engage their teeth by means of a simple biting action. It follows that virtually the only human beings bitten are those who attempt to capture beaded lizards, or who mishandle them. The sole exception on record is that of a hunter who camped in a cave near the Gila River. While he slept a Gila Monster attempted to climb over his chest. "Disturbed by the touch of the animal, the unfortunate man, without opening his eyes, threw up one hand to dislodge whatever it was, and catching it by the tail would have thrown it from him, but the deadly teeth of the monster fixed immediately in his naked wrist . . ." A fair amount of venom must have been introduced into the wound, for the man died a few hours later.

So the beaded lizards can be dangerous, but only in self defense. If left unmolested they are as innocuous as other lizards. Nevertheless this ability to defend themselves has given them bad reputations. Francisco Hernández, the earliest Mexican naturalist, in a manuscript completed prior to 1577, referred to the *Escorpión* as a "frightful kind of lizard." Taking his cue from Hernández a German naturalist later supplied the scientific name *Heloderma horridum* still in

use. Cope, the American zoologist, who first recognized the Gila Monster, followed suit forty years later and called it *Heloderma suspectum*.

Like any venomous, more or less secretive animals, the beaded lizards have, not unjustifiably, of course, acquired sinister reputations. But until fact began to supplant folklore, either lizard would have found it difficult to live up to what was expected of it. In Mexico it was believed that the venom dropping from the mouth of a captive *Escorpión* would cause all vegetation to wither for yards around. The Gila Monster was even more spectacular, according to an early account that described it as hissing in such an offensive manner that its breath issued from its wide open mouth "in puffs of black vapor or smoke." The author of this statement even claimed that he himself had seen a chicken and a small puppy "killed by the hissing of one in their faces."

Such beliefs were so widely entertained that in 1890 a newspaper in Arizona published a letter telling how a woodcutter had died in the Huachuca Mountains. Apparently in the best of health, he had wrapped himself in his blanket for the night. When he failed to rise from his bed in the morning his companions found him "stone dead, and near his body a Gila Monster . . . As the body of the man bore no marks of a bite or other wounds, we must suppose that his death was caused by the mere exhalation of the lizard."

Needless to say, the supposition was gratuitous. But the fear engendered by the knowledge that the Gila Monster was able to defend itself effectively led to all sorts of odd assumptions. It is still widely believed in Arizona that the Gila Monster "lacks the conventional disposal system," having "done away with the need for an opening at the lower end of the digestive tract because it eats so little and is so sluggish." This notion seems to have been set forth in an effort to account for the presence of venom, and the lizard has been described as a "walking septic tank."

Early accounts describe the Gila Monster as a "sort of cross between a lizard and an alligator," or as "consisting principally of mouth." The first American settlers in Arizona and the Forty-niners en route to California a century ago doubtless got many of their ideas concerning the Gila Monster from the Indians in the region. An Apache described as brave and courageous on many another occasion could not be induced to go within ten feet of a Gila Monster under any circumstances.

So the poor lizard's unwarranted but nevertheless unsavory reputation in the valley of the Gila River resulted in its being called a Gila Monster — a name that seems to have been in wide use when it first appeared in print in 1873. But it is a monster in name only. Its real fame — and few lizards anywhere are so widely known — lies in the fact that it evolved an effective means of protecting itself.

This "Kinkajou" Was Really the Very Rare Olingo

By RICHARD H. MANVILLE

A NEW ACCESSION is always exciting, particularly when it is a species never before in our collection; this is doubly so when the animal is a rarity, as is the case with the Olingo (*Bassaricyon gabbii* Allen) now on display in the Small Mammal House. This mammal was first described from fragmentary evidence — a single

skull from Costa Rica and a skin collected in Ecuador — in 1876. An Olingo was on display at the London Zoo in 1894 and as far as the published records go, there have been very few shown in this country — in recent years, one in private hands and one in the National Zoo in Washington.



The Olingo is a small member of the Raccoon family. Its close relationship to the Coati-mundi (*Nasua*) and the Kinkajou (*Potos*) is evident, and yet there are distinct differences in cranial structure, dentition, nature of the brain and coloration. Superficially, the Olingo has the appearance of a diminutive Kinkajou. In form it is elongate, with a flattened head, pointed snout, small rounded ears and a tail longer than the head and body combined; the soles of the feet are partly furred, the limbs short with sharply curved claws; the fur is thick and soft, of a golden brown color. It has been suggested that this resemblance may be a case of true mimicry; yet this seems unlikely in view of the close relationship of the Kinkajou and the Olingo, and no possible advantage to the latter from imitating the Kinkajou is apparent. The Olingo differs from its relative most conspicuously in having a bushy tail that is not prehensile but long-haired to the tip and somewhat flattened as in a squirrel; thus the tail cannot be used for grasping and hanging, but it

is useful for balancing and for warmth and protection when the animal curls up, in the manner of a dog, for a nap. The tail is faintly ringed, suggestive of a Cacomistle (*Bassariscus*). The Olingo differs further in having a sharper snout with a grooved muzzle, and a short, grayish face, whence the common name "Pale-faced Kinkajou." But since the animal is not a true Kinkajou, perhaps the local name of "Olingo" is more appropriate, though the natives of Panama use it alike for both species. The name "Cuataquil" has also been applied to it locally.

We have learned really very little of the habits of the Olingo in the years since its discovery, and a good deal of the meager literature on the creature may be traced to inference from the habits of the Kinkajou. The Olingo ranges at least from Nicaragua in the north to northern South America, and occurs from near sea level to an altitude of about 5,000 feet. Throughout this area two different species probably occur — *Bassaricyon alleni* east of the Andes from Peru to British

Guiana, and *B. gabpii* to the west from Peru northward into Central America. They are distinguishable chiefly by cranial characters, and several races of each species have been described.

Like many of its relatives, the Olingo is largely nocturnal and has a bright eye-shine similar to that of the Kinkajou at night. It seems more at home in the trees than on the ground, frequenting the upper branches and passing squirrel-fashion from one tree-top to another. It is said to construct a nest of dry leaves in hollow trees. Its food appears to consist largely of fruits; in captivity it has fed on an epicurean diet of bananas, grapes, dates, figs and occasionally lean meat. Olingos are more or less sociable, climbing about

At first glance, it is not surprising that our new Olingo was mistaken for a Kinkajou (right). But notice the differences in the tail.

The Kinkajou has a grasping tail (which the Olingo lacks) and it uses the tail not only for balance but for holding on in trees.

in small parties and sometimes feeding and traveling in company with similar groups of Kinkajous, so that it is small wonder that the two have been so frequently confused. Perhaps, with further observations, the Olingo will prove to be more common than has been supposed.

Often we acquire new specimens under odd circumstances, and this is true of our new arrival. Captured in Panama with a group of Kinkajous early in 1955, and mistaken for one of them, it made its way to a dealer in Los Angeles. Still masquerading under false colors, it was acquired by Mr. T. W. Clark for a small zoo at El Ranchito in the Yakima Valley of Washington. Here it became semi-tame and endeared itself to its keepers by its appealing ways and docile, sensitive nature; it even appeared briefly on television. Later in 1955 Dr. Richard G. Van Gelder, a professor at the University of Kansas who shared an interest in Kinkajous, learned of the sale of this "abnormal" Kinkajou from the Los Angeles dealer. Suspecting from the dealer's description



that the "abnormalities" were perfectly normal for an Olingo, he communicated with Mr. Clark and an exchange of photographs and letters brought out its true identity.

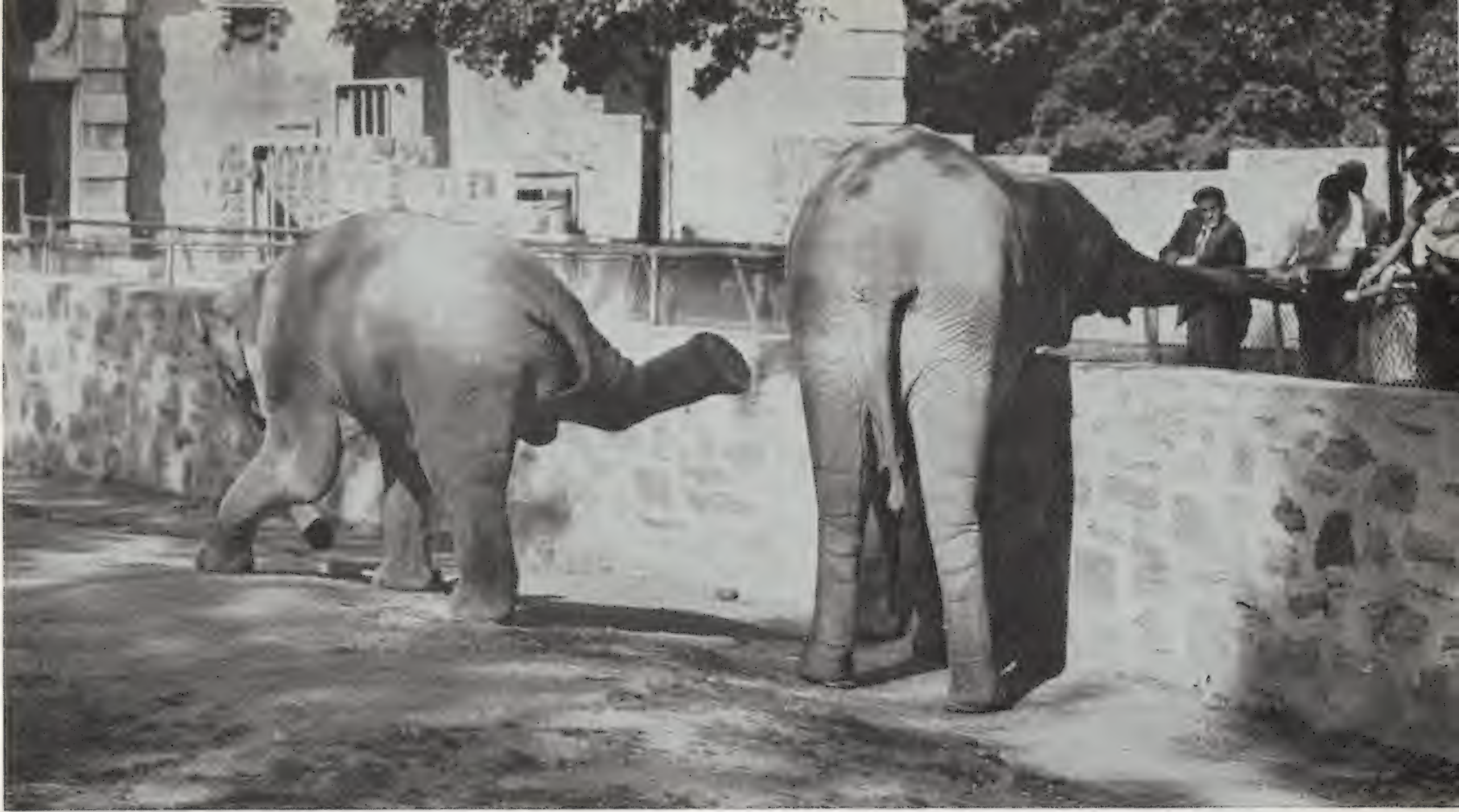
Meanwhile, Dr. Van Gelder had removed to New York to accept an appointment in the Department of Mammals at the American Museum of Natural History, his own collection of Kinkajous remaining temporarily with friends in Kansas. His interest in Kinkajous and their allies, particularly the rare Olingo, persisted. And so did Mr. Clark's desire to obtain a true Kinkajou, which he regarded as somewhat easier to care for and more active as an exhibition specimen. An exchange was easily arranged and proved mutually advantageous. One of Dr. Van Gelder's pet Kinkajous was flown from Kansas City to Seattle and the Olingo winged its way to New York, where Dr. Van Gelder generously presented it to the Bronx Zoo. It is an interesting addition to our varied collection and will, we hope, permit us to learn more of its way of life.

ZOO NEWS IN PICTURES

Photographs by SAM DUNTON

Dr. Hediger of the Zurich Zoo wrote in his book, "The Psychology of Animals in Zoos and Circuses," that begging by animals is "extremely attractive to me from the animal psychology point of view." Dr. Hediger is hereby invited to visit the Bronx Zoo (if he lacks any examples of animals begging in zoos nearer home) and watch young Candy, our juvenile **ASIATIC ELEPHANT**, and her relations with visitors. During the summer, Candy shares a large outside yard with Pinky, an **AFRICAN ELEPHANT**. Pinky is considerably older and larger and, of course, has a much longer trunk than Candy's. Naturally, when food is offered by the visitors, it is Pinky who gets there first and reaches out the furthest. Candy overcomes the handicap to some extent by placing her front feet on the wall, but sooner or later Pinky comes along and shoves her away from the more generous visitors. When that happens, Candy is likely to show her pique by kicking at her companion. And when Pinky lies down for a dust bath, little Candy takes unaccustomed liberties.





Photos above and below by Eleanore Dapper



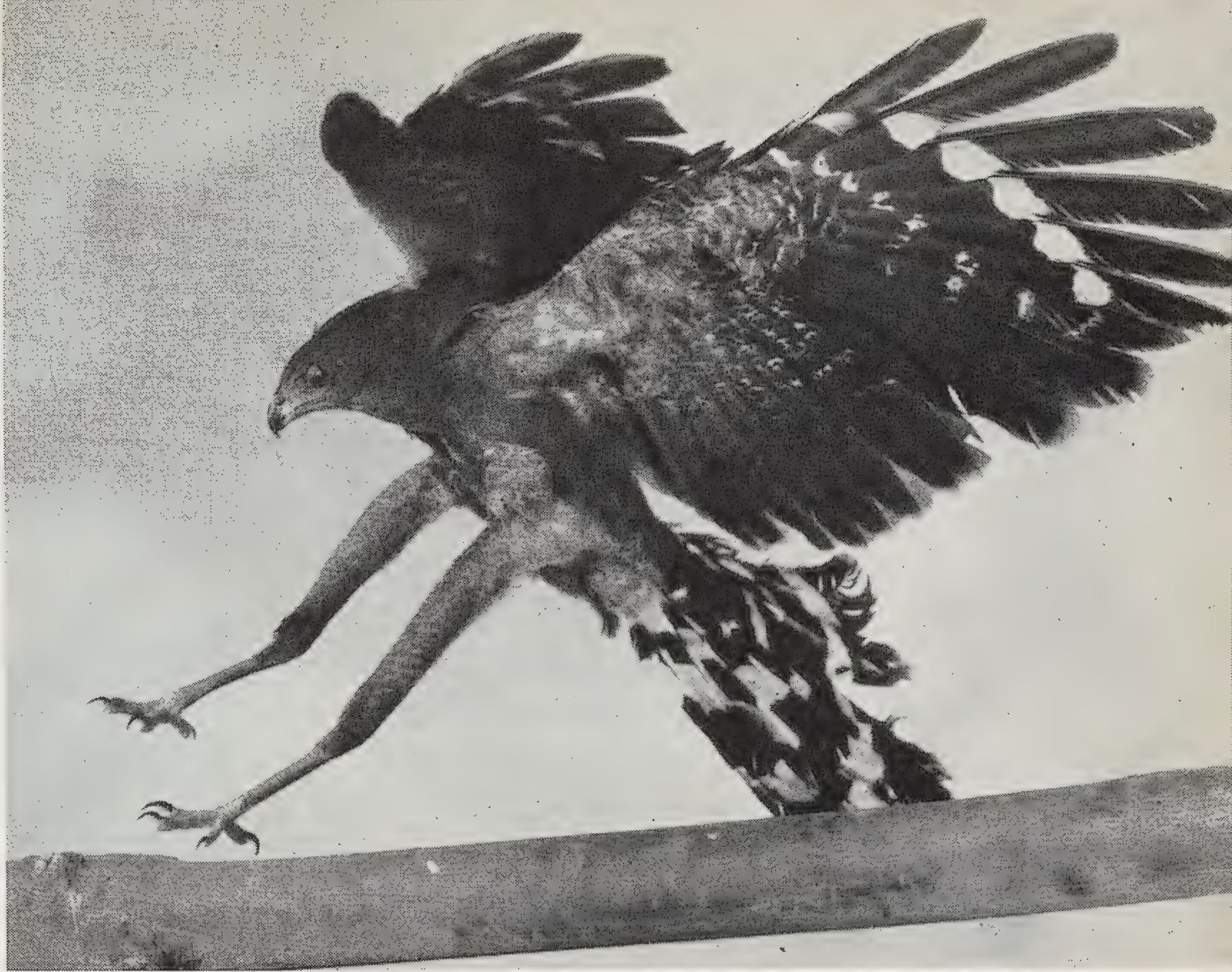


Eight **PALESTINE SPINY MICE** are newcomers to our collection, a gift of George Ballou of New York City. They are the first of these curious small rodents we have exhibited. The lower back is thickly studded with short, rigid spines, giving it the appearance of a miniature hedgehog or porcupine. Another odd thing about the mouse is the brittleness of its tail which, even in the wild, is often found broken off.



"He doesn't know he's an eagle — thinks he's a puppy," is the way Keeper **JOE BELL** of the Aquatic Bird House describes the immature **BATELEUR EAGLE** we acquired this summer. The bird obviously enjoys human companionship and was, indeed, said to have been a house pet before a collector brought it to us from Africa. Keeper Bell devotes a good deal of time to playing with the Bateleur and we hope to keep it quite tame.

the downy cygnets were produced by a pair of **MUTE SWANS** this summer. We lost one of them almost immediately through an accident — apparently one of the parents stepped on it. The same pair of adults reared two cygnets last summer and, like all swans, the male was extremely aggressive during the time his mate was on the nest.



▲ The long legs so apparent in this electronic flash picture of a **GRAY CRANE HAWK** show how the bird gets its name. It is, actually, a bird of swamp and lagoon where it wades and hunts its food of frogs, snakes and lizards. This shy specimen, the first of the species we have exhibited, came to us as a gift of Trustee John H. Phipps. Its home ranges from eastern Colombia and Ecuador down to the Amazon.



Ecologists are Excited by England's "Rabbit Disease"

By H. N. SOUTHERN

*Senior Research Officer, Bureau of Animal
Population, Oxford University*

LET EXPERIMENT BE DONE ON A CHEAP BODY" says the precept (*"fiat experimentum in corpore vili"*) and certainly in Great Britain two years ago no cheaper body could be found than that of the Wild Rabbit, so widespread and abundant a pest had it become. The "burrowing hare" (its scientific name is *Oryctolagus cuniculus*) is well named, for no other species in this group of rodents has made itself so impregnable by an underground life.

The original range of the European Wild Rabbit is thought to have been confined to the Mediterranean area, but it must have begun to spread northwards through France, either by its own efforts or aided by man, during the first millenium A.D. In Britain, if we can judge by negative evidence, it arrived with the Normans about the 11th or 12th century. For many years it made little headway because much of the land was still under primeval forest, in which it does not flourish. Furthermore its northern limit seems to be dictated by the depth of snow and general severity of the winters. Today its territorial advances are arrested in the south of Sweden and in Poland, i.e. as soon as it meets regular, harsh winter conditions.

It seems probable, therefore, that one of the main factors which elevated the Wild Rabbit to the status of a pest in Britain was the gradual warming of the climate which began some 150 years ago. Only in the middle of the 19th century did it begin to penetrate the Highlands of Scotland, but, once established, it found the open sheepwalks of the foothills — cleared of forest some centuries before — greatly to its liking. In



the twenties and thirties of this century it was no uncommon sight to see a whole glen-side practically get up and run away from you.

Similarly on the plain-lands throughout England and the Scottish Lowlands the enormous massacres recorded in the game-bag books of large estates begin to appear about the 1860s and 1870s, a multiplication which culminated in the dispiriting sight of mile after mile of rabbit-sick land in the inter-war years when British agriculture reached its nadir.

Of course, other factors as well encouraged the mass increase of rabbits in Great Britain. The improved efficiency of the sporting gun and the competition between the great estates made it fashionable to try to "bag" a thousand pheasants in a day's shooting, and, where pheasants had to be cosseted and almost hand-reared to produce such results, there was no room for birds and beasts of prey. The extermination, or near-extermination, of many hawks and mammalian

carnivores unleashed the rabbit's powers of increase and, until the passing of the Ground Game Act in 1880, a tenant farmer was not even entitled to protect his own crops from the depredations of his landlord's rabbits.

During the Second World War the Government took strong measures to rehabilitate British agriculture and the fight against the rabbit was "on." Millions were snared, trapped, netted, ferreted and gassed; scrub cover was cleared, warrens were bulldozed, and by the end of the war the result of this huge expenditure of labor and money was that in most of the country highly-farmed land was practically clear and could be maintained so fairly easily. But on marginal ground and in woodland the problem remained nearly as acute as ever. The intensive drive for re-forestation was especially embarrassed because where rabbits lived no trees would regenerate naturally and miles of expensive netting fences had to be erected as protection for young plantations.

The Wild Rabbit (left) has been a pest in England for 150 years. When a hard winter comes along, it turns to tender bark for its food — with the result shown below, where elms have been "barked."

Photo by H. N. Southern

An idea of the havoc that a dense population of rabbits can create can be obtained from the accompanying illustrations. The actual bulk of plant material — cereal crops, grass, tree seeds and seedlings — though immense, is probably less important than the changes initiated in the composition of our vegetation. Rabbits by burrowing and scratching are great disturbers of the soil and weeds like nettles readily colonize rabbit-occupied ground. Furthermore useless, or even harmful, weeds like Ragwort (*Senecio jacobaea*), Bracken (*Pteris aquilina*) and Tor Grass (*Brachypodium pinnatum*) are disregarded by rabbits and so flourish on the low swards from which competing plants have been eaten away. In fact the tale of the rabbit's misdeeds is endless. Against it we can only record the facts that it provides good sport for rough shooting and a living for organised gangs of rabbit trappers.

This is the scene against which the drama of myxomatosis has been enacted. The disease has been known for many years, appearing first in stocks of tame rabbits in Brazil. It seems that the local wild relatives of the rabbit carried the virus in their systems, but were more or less acclimatised to it, as man is to the virus of chicken pox. However, once it arrived in the hutches of tame





rabbits, which are all derived from the wild European species, the course of the disease was spectacularly different and almost invariably fatal. The myxoma organism behaved much like the other pox viruses, passing from the point of injection to the blood stream and multiplying there, then finally appearing as localised lumps and sores all over the skin, especially around the eyes and ears and genital organs. The afflicted animals finally go blind and deaf and die in a coma.

Ever since man first disturbed the original climax vegetation of the earth by clearance and cultivation and thus made it possible for animals in certain circumstances to become pests, he has hankered after redressing the balance by introducing or fostering the enemies or diseases of the pests in question. There has always seemed a sort of poetic justice, as well as great economy, about biological control. As far as insect and plant pests go, the method has often had spectacular success, but with vertebrates, especially mammals, it has usually failed or had disastrous consequences which were unexpected.

Nevertheless the virus of myxomatosis appeared to combine extreme virulence with high

This field was sowed with barley in 1954 and in the normal course of things would have produced a good crop. This is what was left after the local rabbits went to work on the stalks.

Crown Copyright reserved. Reproduction by permission of the Controller of H. M. Stationery Office.

specificity; it failed to kill any other animal, even one so closely related as the hare. It was natural to hope that the disease might prove an easy way of rehabilitating land which was rabbit-cursed. Careful tests were made in Australia and England (the two greatest sufferers), first in enclosures and then on isolated islands. On the islands the disease notably failed to spread and died out after a few confined outbursts. It was assumed that, as so often, ecological conditions in the field — the habits and range of movements of the host and of the disease-transmitting insects — were unsuitable for the exterminations of the enclosure experiments to be repeated on a widespread scale outside.

It was in Australia finally that, as a last desperate fling, the virus was inoculated into Wild Rabbits in 1950. England had hung back, partly because the rabbit was not so desperate an eco-



nomic tax as in Australia, partly because of the widespread public feeling that would undoubtedly be aroused by the dissemination of a disease which — to say the least — is not pretty to observe. The Australians are less squeamish and with good reason. In a land afflicted with periodic drought many farmers have to put up with the sight of mass extermination of rabbits by starvation and thirst and know that their stock will also die because of this. They will reasonably prefer to see the rabbits die of myxomatosis and keep their stock.

The results of this “shot in the dark” are by now well-known. In Australia during the following three years the rabbits died in millions and a rough estimate suggested that some 80% of the population had vanished, with immense benefits to agriculture. There has been some recovery in numbers since and some establishment of less virulent strains of the disease and these processes of adjustment are being studied with attention. By and large the disease is still active and the country relatively rabbit-free compared with its previous sad plight.

In Europe myxomatosis was released in France

And here is the same field a year later after myxomatosis exterminated the rabbits. Scenes such as this can be duplicated in many parts of England since the “rabbit disease” arrived.

Crown Copyright reserved. Reproduction by permission of the Controller of H. M. Stationery Office.

in 1952. By the next year it had swept the board and had leaped across the Channel into the south-eastern counties of England. After the winter’s lull the devastating progress was continued in the British lowlands in 1954, followed by “mopping-up operations” in 1955 and a streaky spread into the higher ground of England and Scotland.

So for the moment England has returned, as far as rabbits are concerned, almost to the condition which existed before the Norman Conquest. The overt nature of myxomatosis and the fact that the dead and dying in many places really littered the countryside have made the occasion front-page news. The farmers and foresters have rejoiced; the shooting fraternity and the humanitarians (a curious rapprochement!) have sent up a wail that a civilised community could allow so barbarous a process to take place, and this in spite of the fact that the Ministry of Agriculture ex-

erted tremendous though vain efforts to contain the first footholds of the disease. Fierce arguments have been waged in print as to whether the fact that rabbits continue to feed quite normally up to the final stage of coma means that they do not suffer so much as the unpleasant symptoms suggest to the sympathetic human mind.

Throughout all this the scientists and the ecologists, though few, have done their best, whatever their personal repugnance to the actual disease, to grasp the opportunity of this vast experiment performed under their noses. Government biologists have carefully traced the progress of the epidemic and have tried to make some broad assessment of the effects on the populations of other animals, as well as measuring the palpable benefits to agriculture and forestry. To the biologist concerned with the fundamental principles of natural population control the occasion has been absolutely unique. Animal ecology, the study of the quantitative relationships between animal populations and between them and their environment, is a relatively new realm of scientific enquiry; furthermore it is vastly laborious because it must be based on census work — the estimation of densities of wild animals and their “turnover” rate from births and deaths — demanding indirect and complicated methods of approach. For example, assessment of the population dynamics of small woodland rodents — mice and voles — needs extensive and periodic live-trapping and marking with some means of identifying individuals like numbered metal leg-rings. Then, if X animals are marked and released and a subsequent trapping shows half of the catch to consist of previously marked animals, the original population must have contained a total of $2X$ animals. This basically simple approach is complicated by a multitude of difficulties in interpretation and these chiefly are what make the work so time-consuming.

Since this is so, it is clear that measurements of wild animal populations in progress when myxomatosis arrived will have been few. I was lucky to have been in charge of one of these few projects and the story of the jolts this project received since 1954 gives us a fortunate insight into the interdependence of the members of an animal community and the way in which a change at

one level will reverberate through the almost endless ramifications relating eaters to eaten.

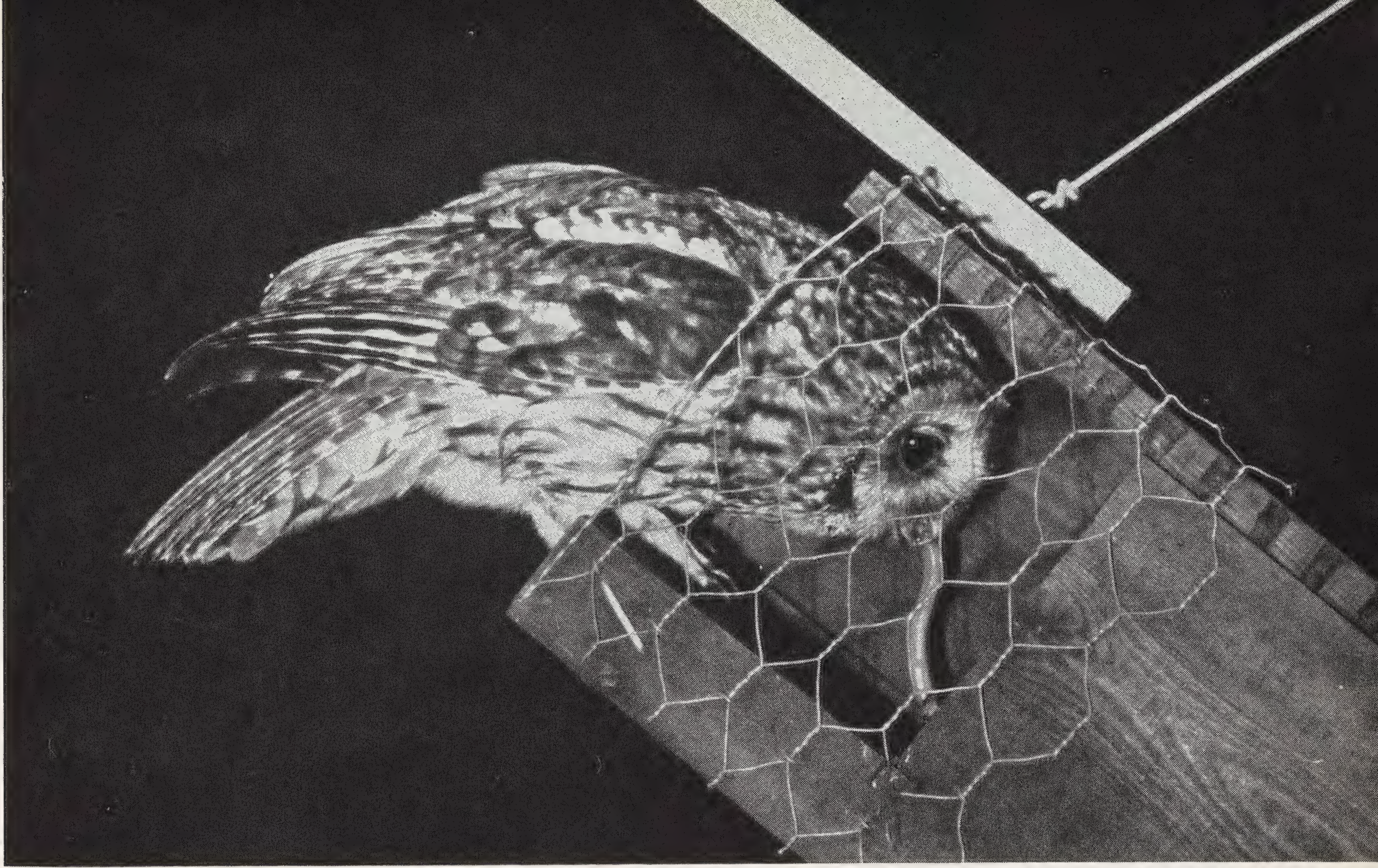
The story really starts just after the end of the war when I became interested in trying to measure populations of a predator and its prey simultaneously in order to detect any reciprocal control, i.e. whether the prey numbers were controlled by their being eaten and the predator numbers controlled by starvation in the absence of prey. A large area of some 1,000 acres, mainly deciduous woodland with oaks, ashes and sycamores, was available for study quite close to Oxford where I worked and this, among other things, determined my choice of studying the Tawny Owl (*Strix aluco*) as the predator, and the Wood Mouse (*Apodemus sylvaticus*) and the Bank Vole (*Clethrionomys glareolus*) as the prey. All these animals are abundant in woodland, the Tawny Owl to an extent which surprised and gratified me, for in some years there have been no less than 26 pairs on the 1,000 acres. This density, for a bird rather bigger than the Barn Owl and one which lives mainly on mice and voles, is an astonishing one.

It took some years to work out satisfactory methods of censusing the owls and of measuring their nesting success each year. Many were induced to breed in nest boxes and other successful ones that nested elsewhere and escaped observation earlier were traced by the noisiness of the young when fledged.

The Wood Mice and the Bank Voles both readily entered small tunnel live-traps and, after a preliminary year's test of catching and marking methods, an intensive study of their populations was begun on 250 acres and large-scale trapping continued at two-monthly intervals for four years. This involved myself and one assistant in walking over 1,000 miles and in handling over 10,000 voles and mice, figures which indicate the amount of energy that must be expended on this kind of work.

The results suggested a close correlation between the density of the prey and the breeding success of the owls. However, the reciprocal effect of the owl predation on the numbers of mice eluded me because errors were revealed in the prey estimates which needed further checking before I could adjust the figures.

In the fall of 1954, therefore, I had just recom-



The Tawny Owl was under study by Dr. Southern when the rabbit disease broke out. Here an owl is bringing an earthworm to its young in a nest box set up for the experiment.

Photo by H. N. Southern

menced live-trapping and marking for a further two years, when myxomatosis arrived. The study area was not one of the worst rabbit-infested types of country, where the kills were extremely spectacular. There were, perhaps, 2,000-5,000 rabbits on the estate, living mainly on semi-open ground interspersed in the woodland, but at the end of six weeks they had been practically wiped out. This was vividly brought home to me by the fact that, when snow fell during the ensuing winter, only two or three rabbit tracks could be found, and it only takes a few rabbits to make a lot of tracks.

Foxes, Badgers, Stoats, Weasels, Crows and Magpies feasted royally while the epidemic ran its course, but the pinch soon followed. The first sign was widespread digging up of the woodland floor, especially in places where ground vegetation was scanty, and it was obvious that these scratchings were made by hungry animals — undoubtedly Foxes — following along the course of mouse burrows and runways.

In the spring of the next year the woods burst into flower as I have never seen them do before. Primroses and Cowslips, two common species of *Primula*, and ostentatious hybrids between them, which are usually rather rare, covered the ground in masses. Normally unobtrusive species, like the Wood Sorrel (*Oxalis acetosella*) and Wood But-tercup (*Ranunculus auricomus*), flaunted themselves in large patches and everywhere emerald drifts of grasses carpeted the rides. When the buds of the Bluebell, or Wild Hyacinth (*Endymion non-scriptus*) appeared, I noticed that none of them had been nibbled and this was the first sign of repercussions among the other herbivorous animals, for Wood Mice are very fond of this spring salad.

This pointer was abundantly confirmed at the next periodic trapping for small rodents in late April. Normally on the 250 acres I operate, with the help of one assistant, 120 traps for 480 trap-nights (i.e. each trap is set for the equivalent of 4 days) and the average catch is about 400 mice and voles. On this occasion I had to increase the number of trap-nights to 720 and we still had difficulty in reaching a total of 100 animals.

Here was a catastrophic change indeed, almost certainly brought about by Foxes, Stoats and



A good example of what happens when rabbits take over is furnished by this derelict pasture in sandy soil in Berkshire. The rabbits have burrowed into it so extensively that it is useless.

Photo by H. N. Southern

Weasels turning to mice and voles for food when they were deprived of rabbits. I waited eagerly to see what the effect would be on the population of Tawny Owls. Normally Wood Mice and Bank Voles constitute their main food in woodland habitats (otherwise I should not have chosen this trio of animals for study) and, although in the summer the owls turn partly to other prey, in spring an adequate supply of small rodents is necessary to start them breeding.

Even in a normal year not every pair of owls succeeds in fledging young, nor even in trying to breed at all, and the usual crop of young from the 26 pairs is about 20. In 1955, however, only four nests could be traced at all and from these only three chicks were successfully brought up. This gave a very impressive measure of the low level to which the small rodents had been reduced. It is, of course, possible that other pairs of owls tried to breed and lost their eggs almost at once (this is particularly difficult to check with the birds that do not nest in boxes), but there can be little doubt that most of the owls never even thought of breeding. This is particularly striking in the Tawny Owl, which is not one of those species, like the Short-eared and Snowy Owls, which live on violently fluctuating prey (Short-tailed Voles, Lemmings) and are accustomed to breed only in peak years.

Effects of this primary dearth of rabbits and secondary dearth of mice were soon detected in general terms, although it was impossible to establish any precise method of measurement, such

as had been worked out for the Tawny Owl. Foxes continued to flourish, partly at the expense of the farmers who kept poultry on the land surrounding the woodland estate. Some half dozen were shot in response to protests by these farmers and none was in poor condition, so that they must have counterbalanced the lack of rabbits by turning to birds and mice.

It was more difficult to determine what happened to the Stoats and Weasels, but I believe, in the light of subsequent events, that they must have been very hard-pressed for food. Certainly they had to become more enterprising in their habits because one or two were actually detected up in the woodland canopy showing an interest in squirrels' nests, an activity which had not been recorded before. I think their numbers must have been thinned by starvation, otherwise the mice and voles would not have recovered so quickly in the fall and winter of 1955-56.

The most interesting feature to me of this experiment performed by myxomatosis was the chance of studying the mode of recovery of the herbivorous animals. Mathematicians predict that, if a predator and its prey are left to interact together in a closed system, each will knock down the numbers of the other in turns — alternately by predation and starvation — and the population oscillations set up will go on increasing in violence.

Ecologists, especially those who prefer the field to the arm-chair, are very certain of one thing, that predicted oscillations encounter some very

potent buffering effects in field conditions. Invertebrate animals in nature suffer wide and apparently random fluctuations in numbers and certain vertebrates have wide cyclical changes in population levels, but by and large the most impressive thing about the numbers of our commoner birds and mammals is the way in which they stay at an approximately even density from year to year despite the vast potential increase of which each is capable.

This buffering effect might be due to two causes. Natural populations may have their densities disturbed like a contour map, which is in a perpetual state of flux, the peaks tending to slide down and fill the hollows, while new peaks are constantly arising in fresh places, themselves to undergo a levelling process by lateral dispersion. Alternatively, if the interacting species, like predator and prey, can swing over to new foods or can attract the attention of new predators, whenever numbers climb, this would automatically prevent excessive populations of predators or of prey building up at any particular time or place.

The great point of interest, therefore, is to watch whether the sudden departure of rabbits has initiated an oscillation in predator and prey populations (the sudden decline of the mice and voles, followed by the failure to breed of the owls and the probable diminution of the Stoats and Weasels show a possible beginning of such a

process) which will continue, or whether the lateral cross-connections between the consumer layers in an animal community can buffer and depress such oscillations, even when so large a spanner as myxomatosis has been thrown into their works.

At the time of writing (May, 1956) the result is undecided. The small rodents have undoubtedly increased over the last winter from their unprecedentedly low levels of spring, 1955. This increase has certainly been helped by the fact that some 17 or 18 young Tawny Owls, which would normally have been fledged on the estate, have not been there to demand food (and each will eat the equivalent of about 4 mice a day); furthermore the Stoats and Weasels have undoubtedly suffered from the dearth of prey. This upsurge of mice and voles has started a bigger proportion of owls breeding than in normal years, but we must wait and see how many of these potential young owls are actually fledged before we can describe the reaction of the owls as a "bumper" season. Some buffering may interfere with the present apparent oscillatory changes.

So far as the ecologist is concerned, therefore, this season of 1956 will be one of the most exciting and critical ones for determining what light myxomatosis with its almost total elimination of rabbits has thrown on the natural processes of regulation of animal numbers.

Our First Pileated Woodpecker

By LEE S. CRANDALL

TELEPHONE CALLS to our Bird Department from kindhearted people who have retrieved stranded or injured birds are routine. The birds come in almost daily and usually result as a simple entry in the daily record. But one that was received on January 12, 1956, was different. A Brooklyn couple, driving on Route 14, near Watkins Glen, at the foot of Seneca Lake in central New York, noticed what seemed to be a bedraggled heap of feathers near the roadside. Many must have passed it by but Mrs. Powers insisted on stopping to investigate. They

found that the feathers clothed a Pileated Woodpecker, very much alive but unable to fly because of a broken wing. Wet, cold and hungry, the injured bird made no effort to resist when its rescuers picked it up. Safely ensconced in a cardboard box, the bird was still alive when the Powers family reached home. It fed freely on bread and milk but efforts to heal the damaged wing were fruitless, so that several days later the telephone call came to the Zoological Park.

It was not long, of course, before the bird itself arrived. It proved to be a female, already recon-

ciled to captivity but with a wing so badly shattered and infected that it could not heal. However, the skillful attentions of Drs. Goss and Gandal soon remedied this condition and the bird is now established in a large, log-filled outdoor cage at the east side of the Large Bird House where, under the sympathetic ministrations of Head Keeper Scott, it is perfectly at home and constantly active.

Off-hand, there might appear to be nothing unusual in all this — similar events take place almost every day. But this happens to be the first Pileated Woodpecker to be received here and the Pileated Woodpecker happens to be a bird of very special interest. Years ago, it was common enough in the great primeval forests of this area. However, as the human population increased, the bird receded accordingly and eventually came close to complete extirpation. Even in the eastern Adirondacks, fifty years ago, the “Log Cock” or “Cock of the Woods” was almost legendary and I can well recall my own hopeful but vain summer searchings for this great bird of mystery. I can recall,

too, the excitement of a summer’s day, many years later, when I returned to a once-favored trout stream in the eastern foothills. A beaver dam had backed up the brook to form a small pond, with the resultant death of many great forest trees. As I pondered a way to reach open water, I heard a resounding hammer-like sound that I knew could be made by nothing less than a Pileated. I crept toward it through the underbrush and twenty minutes later emerged into a clearing just in time to see a great black bird, hardly smaller than a crow, slip in undulating flight from a dead tree trunk. My first Pileated Woodpecker, and at a spot where I knew, only a few years before, no Pileated could be found!

Since that time, this greatest of eastern Woodpeckers has steadily increased in range and numbers. Watkins Glen knows it well, as do northern New Jersey and even the wilds of Westchester. How can we explain the revival of this superb species during a period when the handsome Red-headed Woodpecker, once a common resident, has almost vanished from our ken?

News from the Conservation Foundation

A Synthetic Solution

A group of scientists at the California Institute of Technology has been advising business leaders about the probability and dangers of raw material shortages as population and industrialization expand in the years ahead. The Conservation Foundation has long recognized and often expressed this probability. The scientists emphasize the need for more technical research and trained manpower to develop new substitutes for many essential raw materials, and assert that granted sufficient technical skill and effort the air, the sea and rock may be made to furnish usable substitutes. Unfortunately, in reporting these findings, newspapers have emphasized the hope, rather than the difficulties to be met or the disagreeable consequences of a synthetic solution for current over-consumption of resources.

Conservation Education in the Schools

The long-range program for improving conservation education, which the Conservation Foundation has taken two years to develop, was launched in June. In the first phase, analysis will be made of the plans and curricula of various school systems to ascertain what are the several aims. The second phase is a study, through visits by professional educators to selected school systems, to determine how well these aims are in fact being realized. The third phase will entail the development of tests of comprehension and attitudes and the administering of these tests at various grade levels to determine student progress under the planned programs. The fourth phase will involve the introduction of the most successful teaching methods into a number of experi-

mental schools, to be implemented with special libraries, teacher training and audio-visual aids. There will be further testing from year to year of concepts and attitudes in these schools as well as in a "control group" of schools otherwise outside of the program. Dr. Paul Brandwein will be responsible for this program, and is presently developing the technical staff. The project is supervised by Vice-president George Brewer. Funds are in hand to provide for the early phases of the project, and it is expected that considerable additional funds needed to extend the program to its ultimate usefulness will be provided in the coming year.

President Osborn at I.U.P.N. Meeting

President Osborn flew to Scotland on June 15 to represent the Zoological Society and the Foundation at the Edinburgh meeting of the International Union for the Protection of Nature.

Water Law Symposium

A symposium of invited legal and administrative authorities and technicians from many parts of the United States will open in Washington on October 4 under the sponsorship of the Conservation Foundation. It will analyze the experience of various states as described in technical papers

completed by researchers for the Foundation's current Water Law Study, and emphasize the factors involved in a sound approach to revision of water laws and their administration.

Regional Resource Planning

The Stony Brook-Millstone Watersheds Association, a "grass-roots" organization established five years ago in the Princeton, N. J., area with the aid of the Conservation Foundation, is now embarking upon a pioneering regional planning project in cooperation with the Rutgers University Planning Department. During the summer, a team of Rutgers students will collect and map a variety of data on large-scale base maps of two subwatersheds — data ranging from land use to population distribution, recreational facilities, zoning ordinances, traffic patterns and water use potentials. On the basis of these data, the Planning Staff will draw up recommendations for regional development in consultation with the membership of the Watersheds Association and the county and municipal planning boards included in the area of the study.

This is a unique experiment for it is an indication of how improved resource use can be planned through local initiative within the *natural* limits of a watershed.

BEHIND THE SCENES

**NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH**

Teaching the Teachers

For the past six and a half years the Zoological Park's curatorial staff has given a series of spring and fall lectures to teachers in the public schools on "How to Use the Zoological Park." The lectures, fifteen in each series, range from a history of the Zoological Park to anecdotes about specific animals, and are designed to make the teachers familiar with the workings of the Zoo so that they can teach more effectively when they bring classes to the Park. Forty to eighty teachers have enrolled for each series, and they receive "In-Service" credits from the school system for attending. The lec-

tures are apparently bearing fruit, for in May of this year 64,070 school children came to the Zoological Park in organized classes, some 10,000 more than in May of last year.

Miss Crane to South Pacific

Miss Jocelyn Crane, Assistant Director of the Department of Tropical Research, left July 17 by air for the Fiji Islands, Tahiti, Australia and the Philippines to continue her studies of fiddler crabs under a five-year grant from the National Science Foundation. She will return to New York at the end of September.



No Kings This Year

In the last issue of *ANIMAL KINGDOM* it was reported that our pair of King Cobras had mated and deposited 51 eggs, all but one of which had "gone bad" almost immediately. Subsequently the single remaining egg was found to be spoiled.

On June 8 one of our two pairs of King Penguins laid an egg and one of the birds began incubating it on its feet. During the night of June 14 the egg rolled off and was broken — an accident that is said to happen frequently to incubating Penguins in the Antarctic. The only good thing about the incident is that we discovered, through markings placed on the birds last summer when one pair laid an egg, that it was a different pair that produced this year's egg. With two pairs of egg-laying Penguins, we have a good chance for a successful hatching next year.

Flicker Is Newest Member of the Close-shave Club

Most of the robins, bluejays and flickers in the Dome Cage at the southeast corner of the Bird House are there because of some exceptional circumstance in their early lives. Several were rescued from roadways where traffic menaced them

as fledglings, some were saved from cold rains and others were snatched from the very jaws of predatory cats. One robin and one flicker, that we know of, were taken away from marauding blacksnakes.

The robin came to us a year ago, presented by a New Jersey woman who found the snake in her garden in the process of swallowing the fledgling. The blacksnake obligingly disgorged it and the weak but undamaged bird was fed on pabulum and custard by means of a confectioner's piping bag. It is now a healthy member of our flock.

The flicker, latest addition to the collection, also was part of the way down a blacksnake's throat when the snake was discovered and frightened away. Head Keeper George Scott is hand-feeding the flicker and in a few weeks it will join the colony of other escapees.

Anhinga in Trouble

To Zoo visitors we often owe early notice of untoward incidents in the animal collections — a fight, an injury, improper feeding by the public and the like. Sometimes the situation really does need attention, but more often it settles itself. On a Sunday afternoon in late July alarmed visitors reported to the Bird Department that an Anhinga



Castor and Pollux, the male twins born to our Tiger mother, Dacca, on June 3, had to be removed from their mother a few days after birth because of the reconstruction of compartment floors in the Lion House. As in the past when cubs had to be hand-reared, they were turned over to Mrs. Helen Martini, in charge of our Animal Nursery. At 2:30 o'clock every afternoon (except Thursdays and Fridays) Mrs. Martini brings the cubs from her home nearby and feeds them in front of enthusiastic crowds in the North Bay of the Lion House. Fred Martini assists in handling the cubs.

just received from Bro. Eric reports that the equipment arrived without breakage, the laboratory has been put into operation, and six native students are for the first time being taught chemistry in a laboratory "the equal of any high school chemistry lab."

in the Flying Cage had impaled a sweet gum burr with its lower mandible and was unable to close its beak. Head Keeper Scott investigated and allayed the visitors' fears; the burr was impaled, all right, but the Anhinga would know how to get it off, he felt. While he watched, the bird made several ineffectual attempts to scrape it off on a rock, and then flew to the top of the Flying Cage and resumed its scraping on a perch. By the following morning the burr was gone. Crisis over.

Snakes Exchanged for Chemical Apparatus

For more than a year we have received a series of small shipments of interesting South American reptiles from Brother Eric J. Phillips of the Sociedad de Hermanos, teacher in a mission school near Asuncion, Paraguay. Bro. Eric proposed that the reptiles be credited to the account of the school and when a sufficient sum had accumulated, we send him equipment for a small chemical laboratory.

Crossed Pit Vipers, Coral Snakes and Racers have been received and duly credited, and this spring Curator Oliver selected the apparatus and laboratory manuals the school needed. A letter



Introducing a new arrival in the Small Mammal House: the Palestine Long-eared Hedgehog.

PUBLICATIONS OF INTEREST

GUIDE TO PHOTOGRAPHING ANIMALS. By Sam Dunton. 80 illus., 128 pp. Greenberg, New York, 1956. \$1.95.

Who is better qualified than Sam Dunton to write a "Guide to Photographing Animals"? The New York Zoological Society's staff photographer now tops his many achievements in the art of photography by an achievement in the art of writing.

Not only did I find his booklet pleasant to read and full of humor, but I recognized in it many of the techniques I used in my own career as a newsphotographer when shooting animals. Sam covers every technical aspect of animal photography, expertly advises the beginner on the quality and usefulness of the equipment he can buy on his budget, and tells him where to find

his subjects and how to handle them wherever he finds them.

What personally pleases me most of all, is that I feel in Sam Dunton the same love for animals that I have. This is perhaps a prerequisite for success in photographing animals. The bear and the frog, the cat and the goldfish, each one of Sam's friends, is an individual subject, each a personality to be approached in a different manner. He points out throughout his book how and why taking pictures of animals should be fun for both the animal and the photographer, and that the fun the animal is having is essential to the success of the picture.

And now, before you even start reading Sam's book, take a look at the fellow on page 62. That's an outstanding photo of a caterpillar if I've ever seen one — and don't think he looks unhappy! He just doesn't believe he's photogenic. If Sam shows him that portrait, he may smile next time. — NAT FEIN.

FINCHES. By Ian Harman. Four plates in color, twenty drawings in black-and-white. 138 pp. All-Pets Books, Inc., Fond du Lac, Wis. 1955. (No price.)

Interest in the many members of this composite group as cage birds has been rapidly increasing during recent years. A number of species, such as the Zebra Finch, the Diamond Finch and the magnificent Gouldian, are now almost as thoroughly domesticated as the

well-established Java Sparrow and Bengalee. The author's references are largely to English conditions, so that some species he describes as hardy will live in only the warmer parts of this country without heat. Also some, such as the Virginia Cardinal, the Painted Bunting or Nonpareil and the Indigo Bunting, may not be kept here without special permits. Mr. Harman's excellent little book offers sound advice on the treatment, care and breeding of the better known kinds, including not only the true Finches but also the Weavers, Whydahs, Waxbills and Mannikins. — L.S.C.

THE BIOLOGY OF THE AMPHIBIA. By G. Kingsley Noble. 597 pp., 174 text-figs. Republication edition by Dover Publications, Inc., New York, 1954. \$4.95.

Noble's "Biology of the Amphibia" has been the standard English language reference work on the amphibians of the world for nearly a quarter of a century. It has long been out of print and an eagerly-sought item on book dealer's lists. In fact, copies have been sold for as much as \$25.00. This reprint edition is unabridged and contains a biographical sketch of the author written by his wife. While our knowledge of the Amphibia has increased greatly since the first appearance of this book, there is no other source in English of the basic information contained in this volume. Dover Publications is to be commended for its farsighted action in making this information again available to students. — J.A.O.

New Members of the New York Zoological Society (Between May 1 and June 30, 1956)

Founder in Perpetuity
J. Watson Webb

Patron
Mrs. Edward L. Ballard
Henry Sears

Life
Howard Bayne
Mrs. Morris Pratt Frost
Mrs. Darwin R. James, III

Contributing
Mrs. Amory H. Bradford
Miss Janet Zaph Briggs
Hendon Chubb
James M. Doubleday
Mrs. Carl Eggers
Mrs. Blair Flandrau
Samuel Fuller
E. B. Graham
L. S. Greenleaf, Jr.
Mrs. W. Averell Harriman
Miss Helen M. Holmes
M. C. Kaplan
Shelton E. Martin
Mrs. Thomas J. Megear
Miss Katherine Milmine
C. Peabody Mohun
Mrs. John J. Radley
Carl R. Sadowsky

Mrs. Albert E. Sawyer
Mrs. R. F. Selig
Whitney N. Seymour
Mrs. Frank V. Snyder
Miss Viola G. Stevens
Paul A. Straub

Annual
Dr. Howard Adler
A. M. Andrews, Jr.
Mrs. Donald Arthur, Jr.
Miss Laura Benet
Mrs. Martin Cafferty
Mrs. Philip F. Chew
James Parsons Chubb
Mrs. Arthur J. Cohen
Dr. David L. Crowell
Miss Adelaide M. de Groot
Seymour Fleischnick
Mrs. John B. Goetsch
Mrs. Jerome R. Goldman
Mrs. Julian C. Gonzalez
Dr. Loren P. Guy
Randall Hack
Dr. Robert G. Hicks
Mrs. Thomas Hitchcock
Seymour Horowitz
John C. Hurdman
David R. Jones
Mitchell Kennerley, Jr.
Everett Kimmel

Harold Lamm
Steven Dean Lesser
Mrs. J. K. Lilly
Miss Judith Ann MacArt
Frank E. McCabe
John F. McKean
Mrs. Robert D. C. Meeker
John D. Mitchell
Mrs. Henry T. Mortimer
Constantine Nickou
Mrs. Paul G. Pennoyer, Jr.
Mrs. Alice B. Pioselli
Master George R. Pisani
Dr. Frank P. Shepard, Jr.
Mrs. Lewis Schilio
Bernard Schiller
Abe Scholnick
Charles D. Siegel
Mrs. Tessie Singer
Earle J. Starkey
Miss Josephine Stewart
Dr. Carl F. Sulzberger
John R. Turner
Miss Joan Van Orden
Adrian Van Sinderen
Mrs. Kenneth Wagg
Laurence B. Weisberg
Mrs. Alexander Wiley
Mrs. Zella Zahler
Dr. Edmund Ziman



*"We had a marmoset and a kinkajou
And Mother took care of the whole darn Zoo."*

One of our longtime members recalled this poignant couplet while visiting the Zoo with her grandchild. Composed by her children and grandchildren, in honor of her thirty-fifth anniversary, it describes, as only good folk poetry can, the role mother always plays when the children acquire pets.

Society members are the kind of people who love animals, had pets when they were children and encourage their children to do as they did. The number of hamsters, dogs, reptiles, parakeets, cats, rabbits, fish, ponies, songbirds, parrots and exotic pets like kinkajous, marmosets and woolly monkeys that our members possess is legion. Almost always it's mother who keeps life throbbing in the thousands of little bodies, and takes over when the titular owner is in school, camp or fast asleep in bed.

We know these pets from the many inquiries our curators have answered over the years and have amassed a wealth of information that is

readily available to members (see list below). In 1917, our General Curator Emeritus of Birds and Mammals Lee S. Crandall wrote the classic book on pets that, although out of print, is still the standard reference work. Our staff has written largely on the subject and their *Animal Kingdom* articles over the years are a veritable encyclopedia. These publications should help members' children — and mother — when the class pet rabbit is entrusted to the 6th grader for the weekend, when a hamster's young must be weaned, when the baby chipmunk is no longer a baby. A little accurate information at a time like that is of great help — and in emergencies a member can always telephone us.

Note the publication you want on the card opposite and we'll be glad to send it to you. And at the same time, send us the names of people who should be Society members — the more members, (mothers, grandpas or children) and the more pets they have, the better we like it.

List of Society Publications on Animal Care

FREE — MIMEOGRAPHED

Peafowl
Canaries
Baby Birds
Hill Mynas
Budgerigars

Golden Hamsters
Chameleons
Praying Mantis
Turtles and Small Alligators (20¢)



ANIMAL KINGDOM



NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT Fairfield Osborn	VICE-PRESIDENTS Alfred Ely Laurance S. Rockefeller	SECRETARY Harold J. O'Connell	TREASURER David H. McAlpin
--------------------------------------	---	---	--------------------------------------

EXECUTIVE COMMITTEE

Laurance S. Rockefeller <i>Chairman</i>	<i>Class of 1956</i> Archibald S. Alexander A. Raymond Dochez Robert G. Goelet De Forest Grant Eugene Holman Warren Kinney William De Forest Manice Harold J. O'Connell Landon K. Thorne J. Watson Webb
George F. Baker, Jr. John Elliott Alfred Ely Robert G. Goelet De Forest Grant David H. McAlpin Robert Moses Harold J. O'Connell Fairfield Osborn Edwin S. Webster, Jr.	

BOARD OF TRUSTEES

<i>Class of 1957</i> Robert E. Blum Percy Chubb, 2nd C. Suydam Cutting Alfred Ely Marshall Field Childs Frick Henry Clay Frick David H. McAlpin Richard C. Patterson, Jr. John H. Phipps Alfred G. Vanderbilt	<i>Class of 1958</i> George F. Baker, Jr. F. Trubee Davison John Elliott Robert I. Gannon Peter Grimm Fairfield Osborn Eben Pyne Laurance S. Rockefeller John M. Schiff Henry Sears Edwin S. Webster, Jr.
--	--

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *Director*
Leonard J. Goss *Assistant Director*

ZOOLOGICAL PARK

Grace Davall . . . *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Leonard J. Goss *Veterinarian*
Charles P. Gandal *Associate Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch . . . *Assistant Curator, Education*
Charles B. Driscoll *Superintendent,*
Construction and Maintenance
Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Curator & Aquarist*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. . . *Research Associate in Ichthyology*
Harry A. Charipper . . *Research Associate in Histology*
Homer W. Smith . . *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges . . . *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*
Rosemary Kenedy *Research Assistant*

Associates
William K. Gregory
John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez
Alfred E. Emerson
W. A. Hagan
Caryl P. Haskins
K. S. Lashley
John S. Nicholas

AFFILIATES

C. R. Carpenter, *Co-ordinator*
Animal Behavior Research Programs
L. Floyd Clarke, *Director*
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen
George E. Brewer, Jr.
John C. Gibbs
Samuel H. Ordway, Jr.
Hugh J. Ross
Robert G. Snider
Peter M. Stern

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

Helen Martini with Tiger
Cubs *Sam Dunton Cover*

Looking for Clues to
Crab Evolution
Jocelyn Crane 130

Mountain Acrobat:
The Chamois
Margaret Altmann 137

Our Upside Down Catfish
Grow Up *James W. Atz* 141

Zoo News in Pictures
Photos by Sam Dunton 144

Lizards of the Sea
James A. Oliver 148

The American Beaver
(Part 2) *Albert R. Shadle* 152

News from the
Conservation Foundation 157

Behind the Scenes 158

Vol. LIX OCTOBER 1956 No. 5

No Limits to Science

IN A POLITICAL SENSE, the concept of "far-flung empire," through long centuries a reality, is now becoming obsolete. In a scientific sense, there are no visible limits, either terrestrial or celestial, to the expanding empires of knowledge which the scientist is constantly building.

These thoughts are evoked by the contemplation of the work of our own institution. Either afield or in the laboratory the members of our scientific staff, like all other scientists, are forever in search of additional knowledge to be gained only through the exploration of new regions of thought and of space.

In regard to scientific work in the field, a current activity of our Society vividly illustrates the above observations. This is the work of a member of our Tropical Research Department, described in this issue, involving studies of the evolution and behavioral characteristics of a single genus, *Uca*, commonly known as the fiddler crab. This remarkable little animal has established itself on the temperate and tropical shores of every continent. These studies were initiated more than ten years ago and are now approaching culmination in field observations in remote and widely separated regions. Two years ago observations were being made on the shorelines of South America bordering the Atlantic; last year, in the region of Singapore along the littoral of the South China Sea; presently, in the far reaches of the Pacific from Fiji eastward to the Philippines.

Scientific work in the laboratory is similarly a process of invading new horizons to establish fact or theory. Either in the physicist's exploration of the universe or the biologist's exploration of life processes on this very small planet, the scientist's "empire" is forever far-flung.

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

OCT 10 1956



Studying living crabs in Malaya is not an arm-chair job. This is the way Miss Crane does it — photographing the daily lives of these tiny creatures on reeking mudflats in Singapore.



In Malaya

Looking for

By JOCELYN CRANE

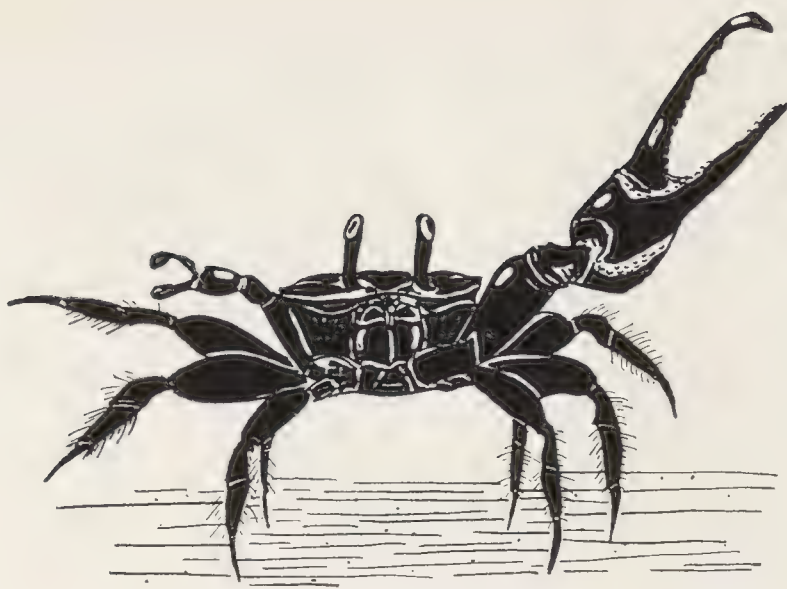
This article was written by Jocelyn Crane of our Department of Tropical Research when she returned from Malaya last year. Now she is on the second expedition of her round-the-world investigation of fiddler crabs, working in Fiji, Tahiti, Australia and the Philippines.

TO MOST PEOPLE a crab is merely the major ingredient of a fairly festive dish. To some it is a bit of fish-bait with a tendency to pinch. And to a few of us it means a particularly interesting kind of animal. In fact, members of one family — the fiddlers, ghost crabs and their allies — promise help in solving so many scientific puzzles that it was worth a trip to Malaya to see thirty-two kinds of them in action.

Almost all the family members are lively and alert. The males often fight one another enthusiastically, and many wave their claws and stretch and bow in a fine variety of displays. Some of these performances, like the songs of many birds, both warn off rivals and play parts in courtship.

All the ghost crabs and fiddlers of America are quite specialized. While they are a wonderful lot, they are unhelpful in yielding clues to the basic evolution of the group. I had studied them for years, from Connecticut to Rio and from California to Ecuador, but it was like trying to trace the family history of dogs from a kennelful of grayhounds and pekinese. It seemed certain that the ancestral path of crab migration had been across the tropical Pacific, from the shores of far Malaysia. To learn the origins of their varied habits and structural adaptations, the only hope was to go out there and try to find, alive and at home, their various relations.

lues to



Evolution

Already available for study were the preserved bodies of crabs collected on expeditions going back a hundred years. In the United States National Museum in Washington were rows and rows of neatly labeled jars. Similar collections stood in the big museums of Europe and the British Commonwealth. Inside the jars were the faded shells and shrivelled eyes of crabs from all the fabled coasts of the East, from Ceylon and Calicut, the Andamans, Brunei, Celebes, Siam. The scientists of the famous oceanographic ships of the eighteen hundreds — the men of the *Alert*, the *Albatross*, the *Investigator* and the rest — had done their difficult jobs well. Large collections were the first essential for a basic understanding of the animal kingdom.

So the crabs had been gathered, to be laid out months or years later on white enamel trays, giving off an unmistakable aura of alcohol-soaked crustacean. The specialists to whom they were entrusted, in London or Paris, Washington or Leiden, would sort the crabs and measure them, patiently compare and describe. Often the authority was a frock-coated savant who never had the luck to see a coconut palm, or himself dig a prize crab from deep in a muddy hole. Necessarily his published descriptions were based only on distinctions that lasted through the years: "Front one-eighth carapace breadth; oblique ridge on manus of major cheliped ending at carpal cavity; carapace strongly narrowed backward . . ." Attached to the beast itself would be a label, giving the crab's name, the expedition, the collector's name, and then something like "January 17, 1888; low tide; Amboina, Banda Sea."

Well, all right, but what was the crab doing on that January day? Was it interrupted in the middle of a fight? What color was its waving claw? Did it wave at all in a formal display? If so would it be of a primitive simplicity?

A very few of the early collectors had been naturalists as well. There were Alcock and Kemp of the Indian Museum, for instance. Working in the early nineteen hundreds, they faithfully recorded many facts about the general habits of Indian species. Occasional observers since in South Africa and Ceylon, Tangiers and Formosa, have brought out a few tantalizing papers, each on some aspect of strange behavior in one or several local forms. Mr. M. W. F. Tweedie, the present director of the Raffles Museum in Singapore, has contributed more on habits than all the rest. Yet, as he has said, a beginning has scarcely been made. In fact, nothing in the way of a systematic comparative study of the living crabs could be attempted by workers who, by the very nature of their various professions, were confined to single areas.

For a long time I had hoped to tackle the problem as a whole, to follow those labels back to their origins, to go into the mists of the family's past by doing detective work on their present. Only thus might one reach an understanding of how they came to be as they are. That, in turn, should shed light on the principles underlying the evolution of other animals as well.

Years ago Dr. Beebe went to the East to make a comparative study of living pheasants on the spot — one of the first and still few groups of animals ever to be so surveyed. With his encouragement and that of Dr. Osborn, and of Dr. Schmitt and Dr. Chace of the U. S. National Museum, I applied for and received a grant from the National Science Foundation. Thanks to it, a trip to Malaya in the summer of 1955 has been completed and two more are scheduled, to Africa and the South Pacific. Both in the preparations and in Singapore, Mr. Tweedie's friendly help was of the greatest value.

On this trip, the collections of the old days

were supplemented and the live crabs studied on the spot, all from a modern point of view and with more recording equipment than used to be possible. For example, the motion picture camera was used freely in recording the behavior, environment and color phases of the crabs; the best of the crab grounds were visited again and again to study territory, social relations and seasonal changes in behavior. Some individual crabs, marked in bright yellow paint, became as familiar as the coolie who sold noodles on the edge of the swamp.

Even collecting was a different kind of job. In the old days, when a yacht or survey ship anchored off a tropical coast, the man who collected crabs was as likely to be the expedition's archaeologist or botanist as the overworked zoologist. The collector, whatever his specialty, would wander along the shore, perhaps merely while waiting for the dory to take him and his own collections back on board. However, bound to improve each minute in that far land, he would zealously gather a few of the largest crabs in sight. These might turn out to be the only ones of their kind, when months later they ended up on the desk of a carcinologist. Nowadays it is clear that the largest crabs of a given sort are not the most characteristic. To describe a new species from a few of these elderly monsters is like publishing an account of *Homo sapiens* based on a row of department store Santas. Therefore on the Malayan trip large collections of all sizes were gathered of every species possible.

And always I tried to find the answers to the major problems: Did the family really originate in the East? How and when did all those species come to differentiate? How do so many closely related species live together without hybridizing? Or do they hybridize sometimes, in some places? From what archaic scraps of behavior — a feeding gesture? a threatening lurch with a brandished claw? — did they build up their complex waving rituals? Do the glowing colors, blue and yellow, white and red, mean anything as signals in their lives? And, above all, are any of them truly primitive? Can any be living fossils?

The answer to the last question was a bang-up surprise that hit me when I least expected it.

Some of the most attractive animals today can boast of being living fossils — old-fashioned mem-

bers of their tribes who have somehow survived up to nowadays. Cecil and Penelope, our famous Bronx Zoo Platypuses, belong among them, but their grace and appealing furriness are not what make them evolutionary showpieces. The Tuatara, the New Zealand rhynchocephalian so much admired in our reptile collection, has an unforgettable, bright-eyed look that does not, however, extend to the exciting remains of its ancestral third eye. The few who have seen it alive vouch for the beautiful blue of the African coelacanth, that survivor of an ancient tribe of fish. And if the Abominable Snowman should turn out, as some wistfully hold, to be a surviving cousin of Neanderthal Man, he will doubtless prove to have attractions which are unguessable from the stolid bones of his ice age kin.

It is that way with a heretofore obscure crab which, among the wide and lively tribe of fiddlers, should surely take precedence as a true primitive. At a glance, the most and perhaps the only attractive thing about it for human beings, is its color, which tends in its youth to be splashed with scarlet. Even the crab's eyes, and sometimes the eyes alone, glow with color from the darkness of the mud. Yet, like the other living fossils, these attractive assets of color are not what make the crab scientifically interesting. In fact, it seemed such a doltish creature that I tended for the first three weeks in Malaya to skimp on it altogether.

Everything about that crab, except its cheerful color, was lumpish. Its large cheliped was rather stocky, with stubby fingers. Its legs were short and weak; apparently they could not support the chunky body for more than a few instants. Whereas other fiddlers race about on tip-toe, defending territories, fighting rivals and chasing females with grace and gusto, this phlegmatic creature moved very little as it fed from the mud, and then with no more verve than a somnolent hippopotamus. Even the scarlet color faded out by the time the crab reached an inch or so in length; thereafter it relapsed into drabness, a purple smear across the claw being, to human eyes, its one remaining claim to glamor.

Nevertheless it was at the crab's scarlet best that I came suddenly one day to appreciate its sterling scientific worth. It was on a warm July afternoon near the Singapore airport. The big planes for Hongkong and Bangkok, Colombo,



Typical of the habitat of the fiddler crabs is this spot on Singapore Island. It is a morass of mud and mangroves, washed by brackish water; here the crabs teem by the thousands.

Karachi and the unimaginable reaches of Europe and America raced down the runway several hundred yards away. They did not bother either the crabs or me, for our world was the small patch of sand and mud and mangrove along the Geylang River. As usual, *Uca manii*, the red-eyed one, was just sitting, eating.

Suddenly, however, it stopped feeding and faced left. A female had just emerged from her hole a foot away. Slowly, the male brought his large, flexed claw up and down several times, raising it just as far as the level of his eyestalks. Each time he heaved himself a fraction of an inch off the ground on his walking legs. Then there was quiet again. After some three minutes of motionlessness he repeated the triple claw-lift at the slow tempo of one heave every two seconds. It had such a ponderously unenthusiastic appearance that one expected to hear rheumatic creaks from all his numerous joints. Finally he moved over toward the female, pausing now and then to repeat his unsensational performance. When he reached her, he touched her walking legs with his, whereupon she broke it up by vanishing

down her burrow. After that he just sat, for an unconscionably long five minutes, and then dragged himself over to his own hole and resumed his meal.

The procedure was repeated at least several times on each of two successive days, and subsequently I saw it many times with other pairs involved. One couple eventually carried through and mated. In none of the preliminaries did anything either more energetic or more complicated happen and at long last I was convinced that I had been witnessing a fiddler's stone-age-type of courtship which was perfectly in keeping with its archaic structural plan.

In the subsequent weeks there was more evidence. Not only *Uca manii* but two other Singapore species — *dussumieri* and *rhizophorae* — proved to be similar though less extreme primitives. There was a tidy intermediate, *U. marionis*, which sometimes, in the height of excitement, actually unfolded his great claw and waved it above his head like an American fiddler crab. And finally, there were the pink-clawed fiddlers, *annulipes*, which cavorted in more familiar, lively fashion, and so upheld the terpsichorean honor of oriental crabs.

Before the summer was over I had displays recorded in notes and on film of eight of the ten fiddlers I could expect to have found. The ninth



was over in Karachi and the tenth, the Triangular Fiddler, lived on Malaya's west coast. So I flew up to Penang from Singapore.

The Triangle, because of the shape of his shell, the width between his eyes and the form of his great claw, seemed in some ways primitive and in others rather specialized. His waving therefore should be especially interesting.

As we drove out to the mangrove swamp early that morning I hoped for the sunny weather that fiddlers prefer for their displays, and especially I hoped to find a colony of *triangularis*.

The car stopped at the edge of a Malay fishing village. Carrying collecting gear, camera and tripod we hurried along the beach toward the mangroves at the end. There were neat thatched huts on stilts, people in bright sarongs called greetings as we passed, and we picked our way among boats whose staring eyes gleamed with fresh paint. Just ahead of us a man picked up a sea snake stranded by the tide, and threw it out into the bay. Beside the last house there was a pile of refuse which included three yellow and black squillas — distant cousins of shrimps — a good eight inches long, and a castoff octopus in turquoise. Any of them would have been a pride to our new Aquarium. Then we were at the mangroves, their glossy green showing fresh above curving stilt roots and the broad dark spread of the low-tide mud.

Suddenly we saw some tiny bits of golden yellow in the mud. I picked up the nearest and checked it with a pocket lens. There was no doubt: it was *triangularis* itself. In fact, here were thousands of its kind, and the sun was shining brightly. All conditions were right for the work of recording its display.

But here my tale of the Triangle Crab comes to an end as inconclusive as one of those exasperating problem novels. The vexing animals did not display, not once, all that morning or the next. They simply sat in their legions and infuriatingly stuffed mud into their mouths. They doubtless did an excellent job of sifting out the nutrient, but I was in no mood to be impressed. Not

TOP — A female fiddler, without a large claw, is next to a large-clawed male. **CENTER** — A fight between two male fiddlers. **BOTTOM** — A male at the entrance of its burrow in the tide-wet sand.



only did they give no hint of their waving pattern, but they paid no more attention to one another than hurried strangers at an airport snack bar. It simply was not their courting season, and I had to go back to Singapore leaving their behavioristic secrets still locked tightly in their glands and ganglia.

Most other times I had better luck. The summer passed, notebooks filled, and thirty-four hundred feet of motion picture film were hopefully sent home for processing. In the film was the unequivocal record of bits of behavior patterns. In due time these will be studied under a microscope and run repeatedly, at flicker slowness, on a screen. Through this kind of tedious work the evolutionary puzzles will be partly solved and perhaps the origins of even complex activities will come clear. On the film is preserved not bodies but behavior: for example, that really superlative fight of *Macrophthalmus* at Penang, where two males gripped each other for four minutes by a stop watch and tumbled about in such confusion that it was impossible to see what part their large claws played. It had never before been known that this genus fights at all.

The film contains a record, too, of the chimney-building of certain fiddlers, for purposes unknown; of the astonishing behavior of *Dottillopsis* in Sarawak where the little flame-legged crabs ferried mud in their mouths, in tiny packets, at racing speed, to stop their burrows against the tide. Why did they not carry the mud like their

The muddy beach at Penang was the home of the Triangle Crab whose display Miss Crane wanted to study — but it refused to display. The boat has “eyes” so it can find its way.

relatives, at leisure in a few large loads held in several off-side legs? What was the origin of a method apparently so inefficient? On the film there are also displays by the dozen, repeated many times over to show differences among genera, species and even among the same species in different parts of its range. One widespread fiddler, *U. annulipes*, was filmed all the way from Pakistan and Ceylon to northern Borneo. If current plans work out, it will eventually be the star also in films made in Eritrea and Fiji. The results may show the species on the way to splitting into subspecies, somewhere between Manila and Zanzibar.

Meanwhile I appreciated the extra dividends of strangeness and color and understanding presented indirectly by the crabs. Never before had a purchase of glass jars for specimens been added up for me on an abacus; never had I bought formalin from a shop that also sold pulverized rhinoceros horn, or laboratory towels from a Malay whose chief stock was sarongs. My low stool for mud-sitting came from a Chinese who specialized in good luck signs in scarlet and gold; he also made up, on request, gaily lacquered altars for family shrines. When I lost a trowel for digging crabs, no replacement could be bought.



When glass jars were needed for preserving some of her crab collection, Miss Crane found them in this “laboratory supply shop” in Singapore. It sold all sorts of wares, from joss sticks to rhinoceros horn.

So one was forged to order by a Singapore smith in a pointed pandanus hat.

Never before, either, had I sheltered from the rain in a fisheries bureau cottage across a narrow strait from a sultan’s palace. On that cottage wall was a sign that brought the eight-year troubles of Malaya very close. In three scripts it forbade carrying any foodstuffs or clothing or flashlights across the straits, lest the communist bandits receive aid and comfort. The troubles seemed close another day, beside another official sign. After a short cut to the airfield from an upcountry mangrove swamp, my car passed a large billboard which triumphantly announced: “You are now entering a WHITE AREA.” In the local parlance that meant the neighborhood had been cleared of trigger-happy terrorists. I wondered what we had in-

advertently been passing through before—BLACK, which meant forbidden to civilian traffic, or merely GRAY—“use your common sense” and, no doubt, “avoid wandering about in the mud.”

Far more typical, however, were the friendly, daily happenings of work in an alien land. At Bedok one morning all the crabs suddenly vanished down their holes and I looked up to find a small Malay girl in a yellow-flowered sarong. She smiled widely and with no introduction at all sang out “My Mommie’s gone to Mecca!” And gone she had, too—one of the first women to participate in such a pilgrimage, and her little daughter was justly proud. It was illuminating to realize that she had gone *westward* to Mecca—as far west from her land as that fabled city is east from New York.

Meanwhile the child picked up an old tin and trotted a tactful fifty yards away. There, unasked, she began to catch unwary crabs to add to my collection. She was doing her own good job of helping international relations.

Mountain Acrobat:

THE CHAMOIS

By MARGARET ALTMANN

*Moose & Elk Researcher, Jackson Hole
Biological Research Station*

MY STUDIES of social behavior in free-ranging animals in the Jackson Hole region of Wyoming led me to visit the Chamois (*Rupicapra rupicapra*) of the Alps. Intelligent and speedy in reactions, these curious inhabitants of the upper alpine regions are so elusive as to permit only sporadic contacts with the native villagers. Legends have been woven around their lives but even the active hunters know little about their habits.

Both the buck and the doe bear horns, but the buck's are slightly stronger and more curved. The Chamois looks like a goat, jumps like an antelope, furnishes, as a great trophy, the "beard" for the Tyrolean hat, and gave the soft leather, "shammy," its name. But in strict scientific fact it is neither a goat nor an antelope, but belongs to a separate group of goat-antelopes. And it has no beard. The so-called Chamois beard is composed of carefully plucked, long, white-fringed hairs growing along the backbone. The "shammy" one buys today is very likely made from domestic sheep or goat skins.

I found that there is no trophy more admired by the mountain villagers of the Tyrol than a good Chamois beard. In the 16th and 17th centuries it was believed that this would give a hunter special strength and endurance; it was a hunter's special privilege to wear a "Chamois beard" on his hat and it was punishable by law for other people to wear it.

I set out to observe the Chamois from a village near Salzburg in the Tyrolean Alps, with the local game warden as my guide in the steep and rugged mountains adjoining the lesser slopes and drainages. We made camp in a mountain cabin: White-cliff Cabin close to the timberline. It was

early November and the ground was still free of snow as we climbed. Despite the lack of snow, our provisions were carried by a one-horse sleigh

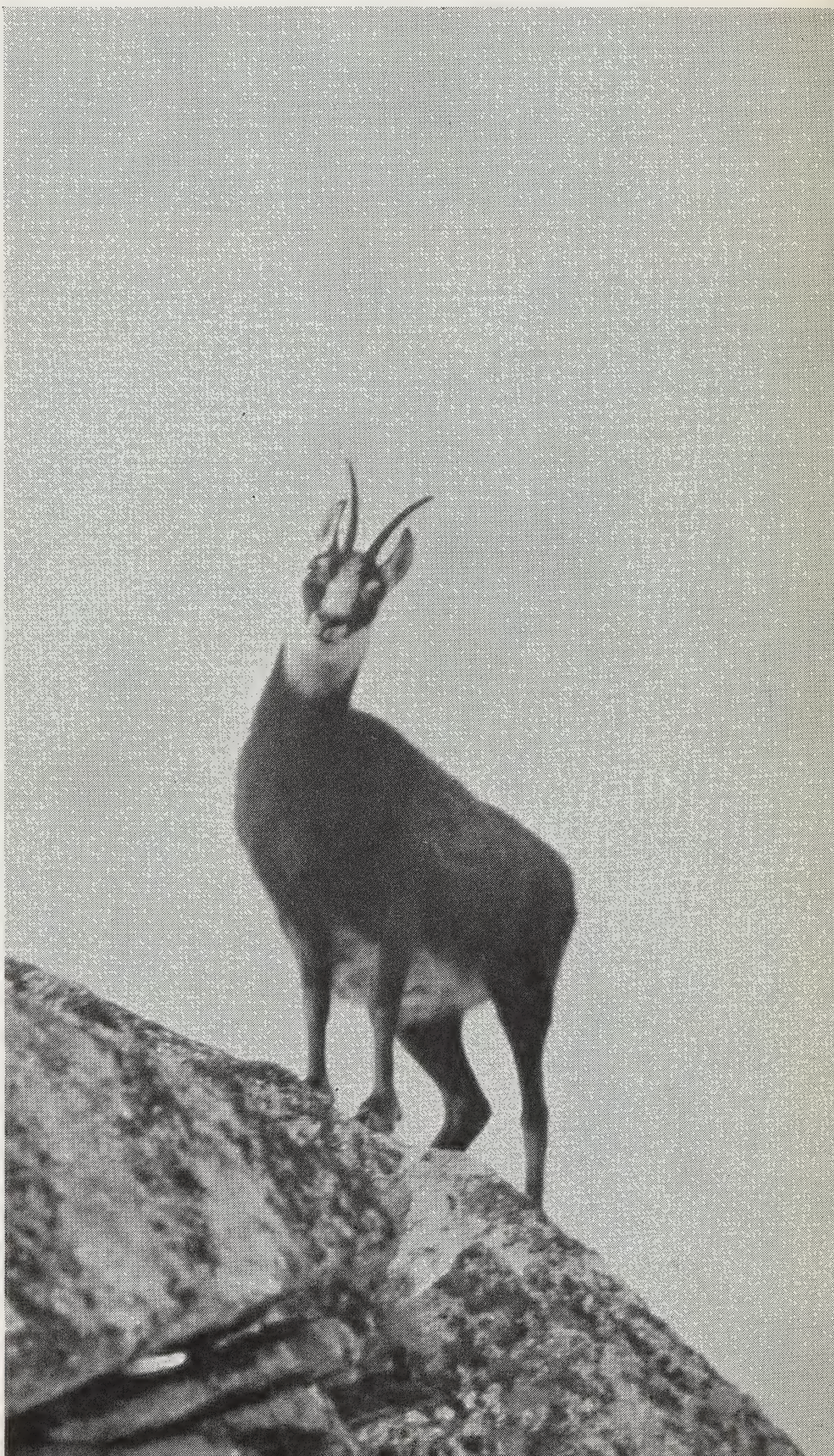


Photo Feuerstein Scuol/Schuls



TOP — Deep winter snows drive the Chamois down from the mountains to the valleys. **LEFT —** In spring small bands drift up to the windswept timberline.

Top: Photo Schocher Pontresina

Left: Photo Feuerstein Scuol/Schuls

with long curved runners, surprisingly efficient at gliding and bouncing over the dried grasses and shrubs on the steep mountainsides.

Thick fog was closing in on the valley as we ascended the narrow trail, and the rocks and scattered tree groups took on ghostly shapes. We saw Chamois tracks in the mud crossing the trail, and then as we emerged from the layer of fog, we reached the cabin nestled below a thousand-foot-high cliff, from whose shining surface the evening sun was reflected brilliantly.

The slopes of mountain pasture were interrupted by stands of alpine fir and spruce, except where a mighty avalanche had roughly cut through the timber. This one barely missed the cabin last year.

These slopes are the habitat of the Chamois flocks. They are highly social animals. In winter, they aggregate in larger herds in the side valleys and lesser slopes, even descend to the village borders when the snow gets too high. In spring

they form smaller bands and drift gradually to the higher, windswept slopes at timberline.

The Chamois bucks remain with the herds for the summer, even when the females give birth to the young. The kids follow their mothers within a few hours after birth, and when the group is grazing they rest or play. Small rocks or tree stumps are favored places for exercise and play. Chamois games are built around the "flight" and "fight" topics, but very early in life the kids show proficiency in steep places. The Chamois doe is often seen resting below the place where her kid is resting. Calls between the mother and the kid are rarely heard, for the group is closely knit and communication is chiefly by sight and scent.

If there is danger, however, the sharp whistle signal of the female alarms every member of the group. Sometimes the kid takes a wrong direction of flight and in the confusion jumps off alone, but soon it learns to stay with the group and depends on speed as a stabilizer on the rocks. How do the Chamois move so surely, so elegantly, over the steep, slippery rocks? Perfect balance in motion is their main secret, but they are aided by their elastic, soft-walled hoofs, which serve as suction cups on the bare rocks.

When the local cattle are driven up in the mountains for the summer, the noise of the cow-bells and the clatter of milk-pails make the shy Chamois retreat to the rocky upper regions above the "cowline." In the fall the first snow and cold spell bring unrest to the Chamois. The breeding season is beginning and the bucks leave the bands for solitary wandering. Now they wallow in springs and pools, they rub their horns against shrubs and protruding rocks, and a waxy secretion from two glands, one behind each horn, marks their territory. A mature buck soon forms a harem by joining a band of females. All young bucks, even the yearlings, are driven out of the flocks by the jealous harem-owner and fighting occurs when his threatening gestures are not heeded. At first the fights are usually mock affairs, sparring or display of intention. The horns of the Chamois are designed to tear, not to stab the opponent, but serious fights are rare and occur only when the partners are very well matched.

The bucks are tireless in guarding their harems against intruders of their own species. The shiny, well-rounded appearance of a Chamois buck in the early stages of the rut soon gives place to leaner lines, for he rarely has time to graze or

The breeding season begins with the first fall of snow and the bucks wander by themselves. On shrubs and rocks they rub their horns, leaving a waxy secretion from two glands as a territorial mark. A mature buck soon forms his harem from the female bands.

Photo Prof. H. Hediger





Chamois kids follow their mothers a few hours after birth, and very early in life they show great proficiency in climbing over the steepest rocks. This kid is only about 3 hours old.

Photos Prof. H. Hediger

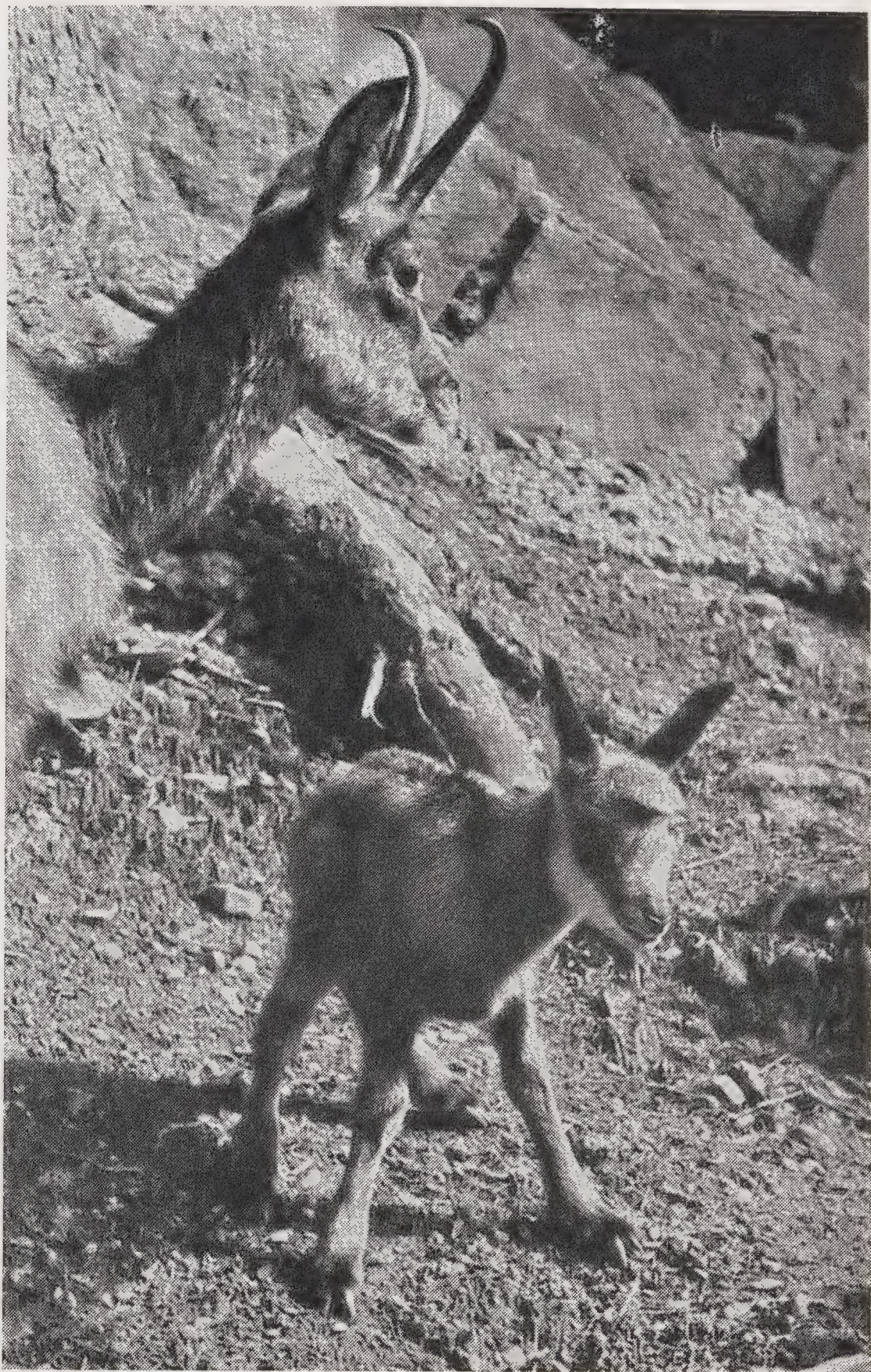
browse in peace. Ordinarily shy and wary, the buck becomes careless of his own safety during this time. I have seen a game-keeper fool a rutting buck by breaking little sticks and branches in the thicket. The buck quickly ran toward the noise, believing that another buck was trying to approach the harem.

Chamois bucks have a trying time in the rutting season. All their attention is focused upon intruding rival bucks, but the does are alert to warn and move the whole group to safety, if needed. When the fall rut is in full swing, snow flurries and fog often cut visibility but the chances of seeing and observing the Chamois do not diminish. If you know where to find them, you can stalk them even in a cloud of fog.

The village people in the Tyrol told me that the Chamois would be hard to approach. "They post guards when they are grazing and resting on the slopes," they warned me. My careful observations did not confirm this point. But the Chamois' habit of facing in different directions when grazing or resting serves in fact as a protective device which made it difficult to stalk the groups. In dense timber they hear and react to the noise of breaking twigs. On open, rocky slopes they feel the vibration of footsteps over a

great distance. Their vision, too, is effective at long distances.

But the dwarf pine vegetation at the timberline provided good hideouts and cover for approach when I watched the Chamois in the daytime and at dusk. At times when the light snow cover was frozen over, I could not avoid making a noisy step, and then followed the shrill warning whistle of a female and in a few seconds the whole flock would be gone, with only an occa-



sional falling rock to indicate their direction. Unlike our American Elk, the Wapiti, the Chamois do not travel far after a disturbance. They reappear in the vicinity soon and, being curious by nature, they sometimes even try to see the intruder. Most major slopes in the part of the Tyrol where I was working have their "steady" groups of Chamois. A number of "pulpit seats" — that is, blinds on trees — have been built for the master of the hunt. My observations were often made from these; before daybreak I would

enter such a blind and wait for the resident flock to appear.

An interesting Chamois story was told me by Prof. Hediger of the Zurich Zoo. Since Chamois are typical of the alpine region, it was planned to exhibit a few in the Zoological Gardens of London. The Swiss government graciously donated a group, and they were crated, loaded into an airplane and sped on their way. But fate had it otherwise, according to the story as I heard it.

The plane crashed in the Jura mountains in southeastern France. Everyone was reported killed. But a few years later, Chamois were revealed, in a scientific paper, as being found in the Jura mountains. When the airplane crashed, the crates had broken and the Chamois alone had survived the disaster, had established themselves and multiplied, for conditions were much to their liking. A unique method of introduction into a new habitat, indeed!

Our Upside Down Catfish Grow Up

By JAMES W. ATZ

JUST SIX YEARS AGO the Aquarium acquired its first upside down catfish and since that time a tank containing two or more of these fish has been one of the features of our exhibition in the Lion House. During that time, thousands of visitors have looked and wondered at fish that spend much of their time swimming or resting belly up.¹

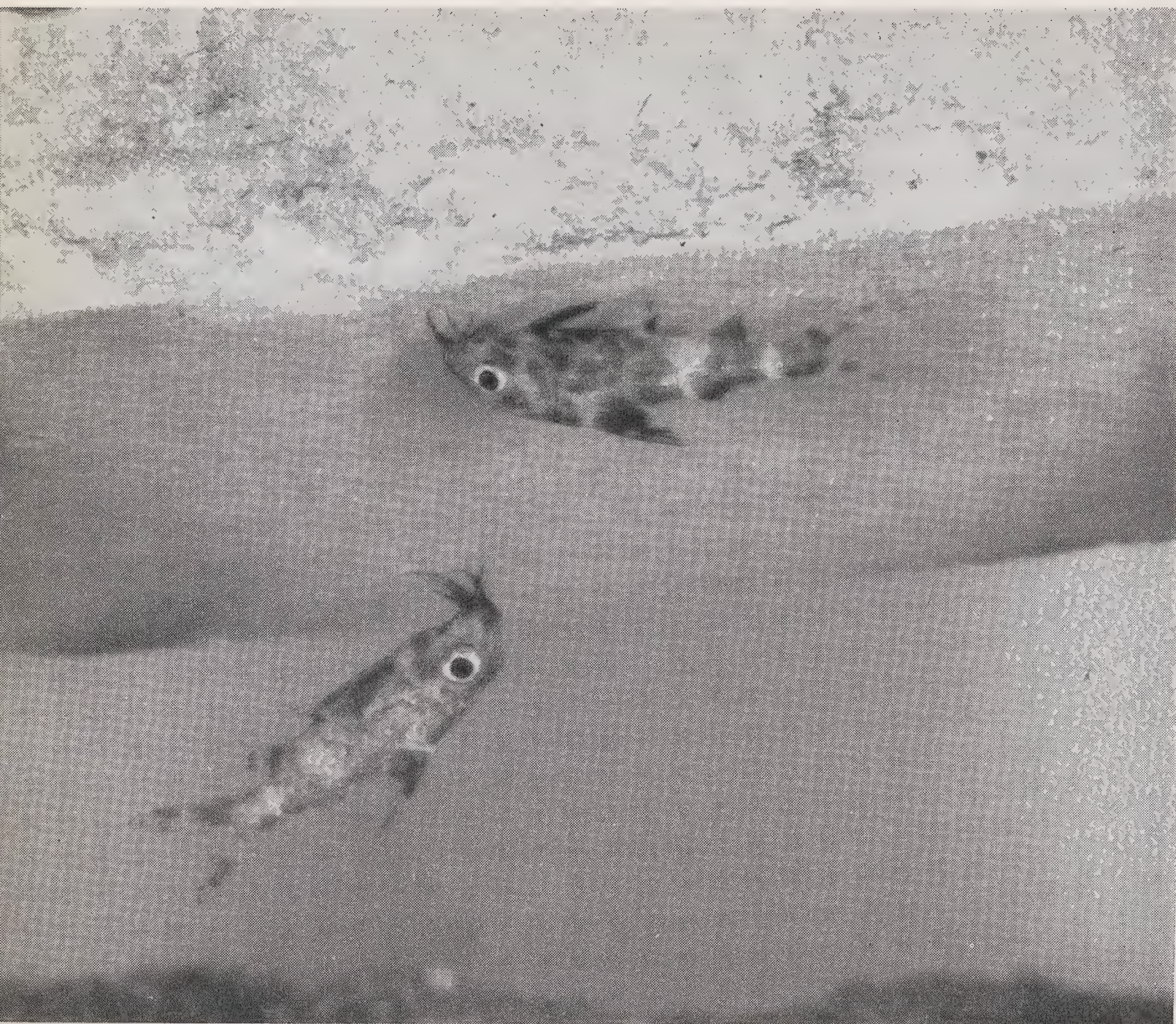
For us, too, our upside down catfish have lost none of the fascination they had when we first saw them in September of 1950. Despite the fact that they have been living under our noses, so to speak, all this time and we have since learned that there are quite a number of other fishes that at one time or another voluntarily turn upside down for considerable lengths of time, the fundamental peculiarity continues to intrigue us. It is, indeed, as if there were a race of men who habitually walked on their hands.

For one thing, we wanted to find out whether the behavior of the fish would change as they got older. Three French biologists, who studied a

closely related species, described how these catfish at first swam normally, but as they grew they more and more frequently took an inverted position. The fish seem to dislike this change, because they appeared to struggle to stay right side up — an effort that became less and less successful as time went on. Finally they remained upside down all of the time. We have witnessed no such change as this in our species of fish. When we first received them, at a size of not quite an inch and a half, they could turn from an upside down position to a more ordinary one and back with equal ease, and they swam equally well either way. The turn might be made as a 180° roll around the long axis or as a loop or dive, that is, nose up or nose down. This still holds true today, when the fish are fully six inches long. Although much of the day or night is spent upside down or in other peculiar positions, the fish can, and frequently do, swim around their tank in the more usual manner, resting back up, like any ordinary catfish.

We also wondered whether our upside down catfish would change color as they grew up. Fishes typically have dark-colored backs and light bel-

¹ An account of these upside down catfish, by the present author, appeared in *ANIMAL KINGDOM*, Vol. 54, No. 1, pp. 18-21, Jan.-Feb., 1951.



This is how our Upside Down Catfish looked in 1951. They were only about 1 1/2 inches long when they came from the Congo.

Now, in 1956, the catfish have grown to 6 inches, but their behavior has not changed. Their name is Synodontis nigriventris.

lies. This *countershading*, as it is called, serves to make the creatures less conspicuous when viewed from the side or from above or below. It might be guessed that a fish that lived upside down would show the reverse coloration; that is, would have its belly darker than its back. As a matter of fact, such a reversed pigmentary pattern is found on three species of upside down catfishes, all of which are known to swim on their backs, but it is not true of two others. The latter exhibit the more conventional coloration even though they have been seen swimming about in an inverted position. Our upside down catfish, the sixth species to be reported to have this unusual habit, belong to the second group. They are a uniform tan in color, covered from back to belly with heavy but intricate chocolate brown markings. The belly is neither more nor less heavily pigmented than the back. This has been the general pattern of their coloration from the beginning, although as babies the brown pattern was not as well developed and they showed light blotches here and there instead.

The behavior of our fish provides a clue to this striking difference in pigmentation. With regard to their color pattern, one might say they are neutral with neither back nor belly being darker.

This same lack of emphasis is found in their orientation behavior: they regularly employ both upside-down and right-side-up positions. We do know that the species that eventually was forced to remain upside down continuously — the one described by the three French investigators — has reversed coloration. Perhaps only those catfish that remain more or less permanently upside down have adopted an inverted color pattern to match their inverted orientation.

Since 1950, when we obtained our first upside down catfish, we have become much more aware of the problem of how fishes orient themselves in their three-dimensional world and we have learned that there are a good many species that swim or rest in an inverted position. First of all, quite a few fishes lay their eggs on the under side of leaves, shells and stones, but these might be considered a special case, since they only assume an inverted position while spawning. Some of these fishes watch over their eggs, however, and must turn over each time they wish to brush them with body and fins in order to keep them clean. We have watched a male Johnny Darter spend as long as eight minutes at a time upside down while he swam back and forth over the eggs fastened to the roof of his nest.

There are also a number of fishes that habitually or occasionally take upside down positions in crevices, holes or overhanging projections. There are many such places in coral reefs, and inquiries made of skin-divers and aqualungers who have explored these places have revealed that fishes lurking upside down in such out-of-the-way spots are unusual but not rare. The small but

regularly took up an inverted position under a narrow shelf in its tank. We were therefore not too surprised when we recently saw a Zebra Fish in an underwater motion picture swimming along upside down.

The fishes mentioned in the preceding paragraphs may swim upside down for short distances, but they seldom, if ever, do so for con-



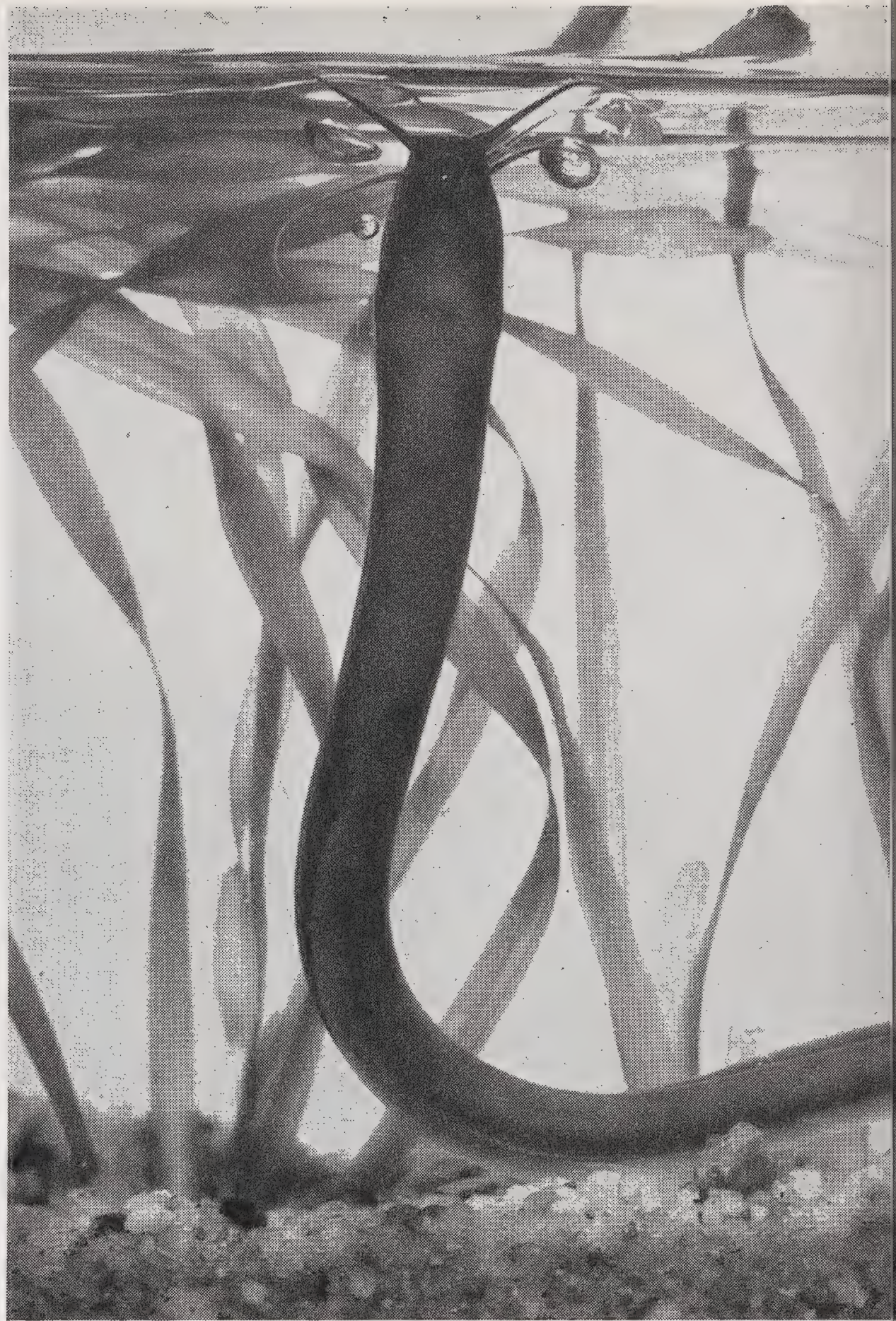
gorgeously colored Fairy Bass (*Gramma hemichrysos*), for example, very frequently rests with its belly up against some overhanging coral rock, according to Frank Trevor and Carleton Ray, both of whom are experienced underwater divers and students of fish behavior. Mr. Ray also informs us that he has observed at least half a dozen other Bahaman species behaving in a similar manner. The Treefish (*Sebastodes serriceps*) of the California coast is another habitual "upside downer." We have it on good authority that the Shedd Aquarium in Chicago exhibited for some time a Zebra Fish (*Pterois volitans*) that

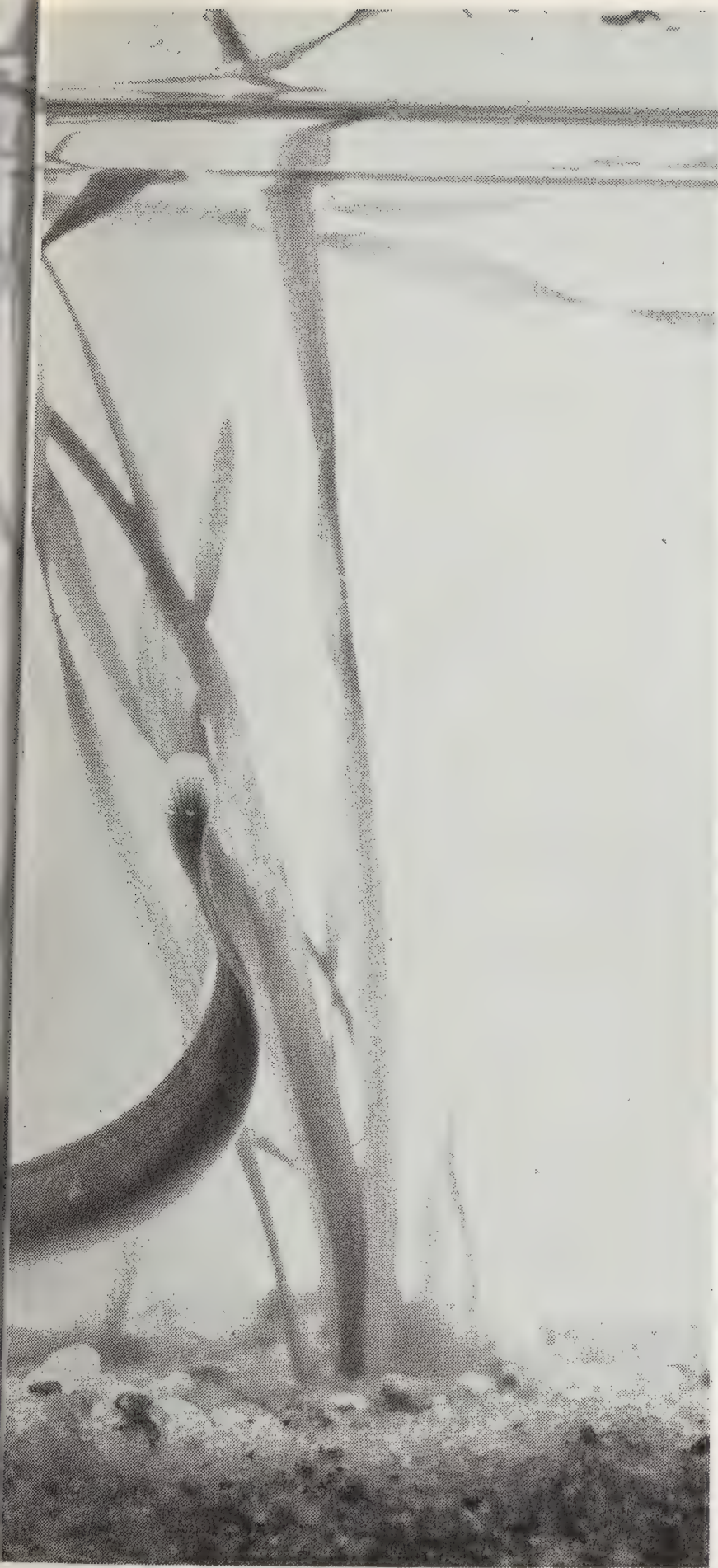
siderable distances out in mid-water. As far as we know, only the upside down catfishes of Africa regularly do this, although there is a report that one of the South American armored catfishes also at least occasionally does so. A recent report also tells of a Striped Mullet seen swimming upside down near Miami Beach, but this is certainly abnormal behavior for such a well known food fish. Most fishes never turn belly up unless severely injured or dying from some other cause. Why certain fishes regularly turn upside down and how they can thrive in such a topsy-turvy existence are questions that still puzzle us.

ZOO NEWS IN PICTURES

Photographs by SAM DUNTON

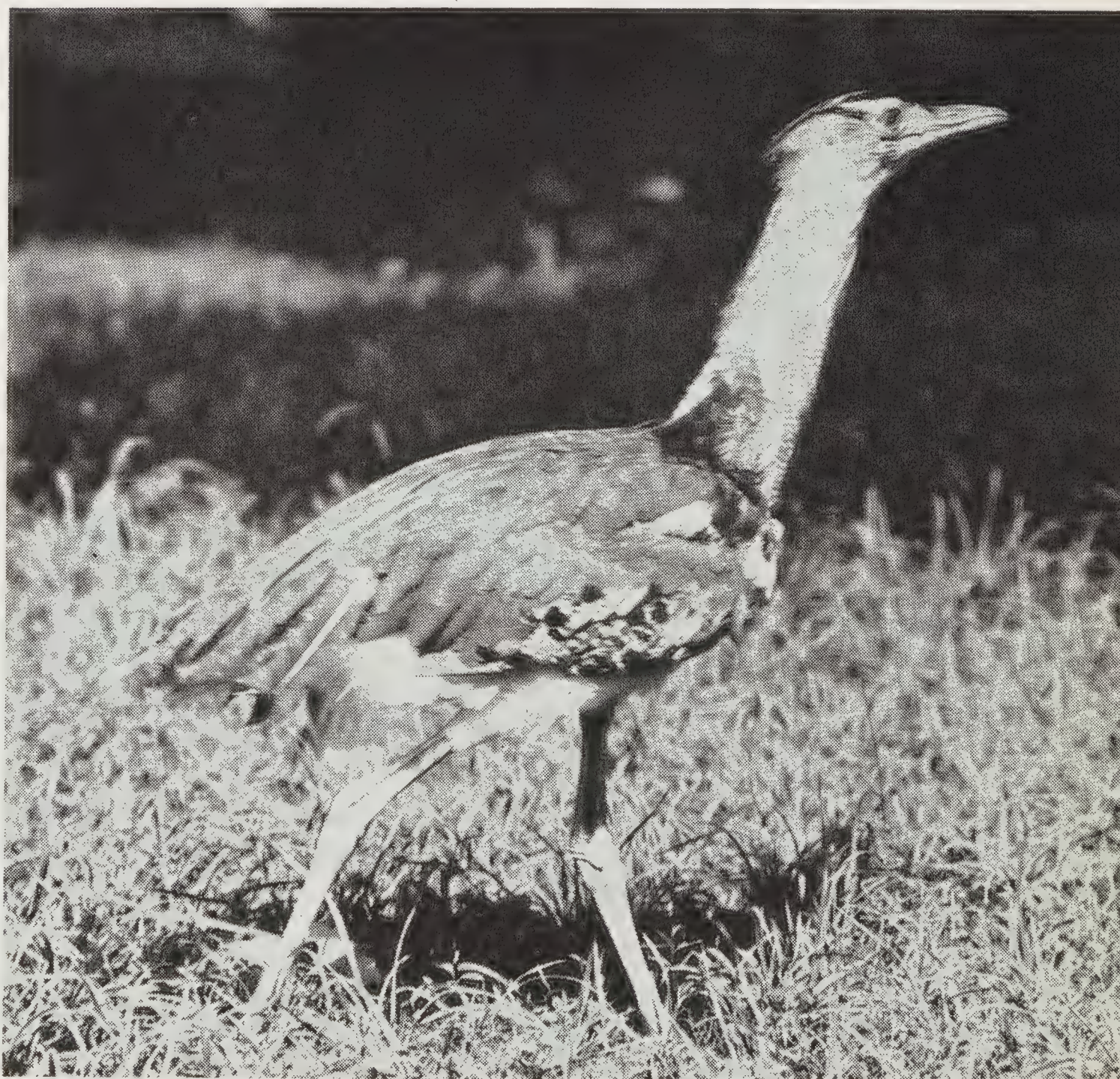
This curious creature from the Belgian Congo and Angola regions of Africa is the **EEL-CAT**, *Channallabes apus*, the first one we have exhibited at the Aquarium. Although it looks so much like an Eel, it is a true Catfish — as evidenced by its whiskers. It has, however, lost all evidence of pectoral and ventral fins. Our specimens are a little less than a foot in length. Very little is known of its mode of life, its feeding habits or reproduction.





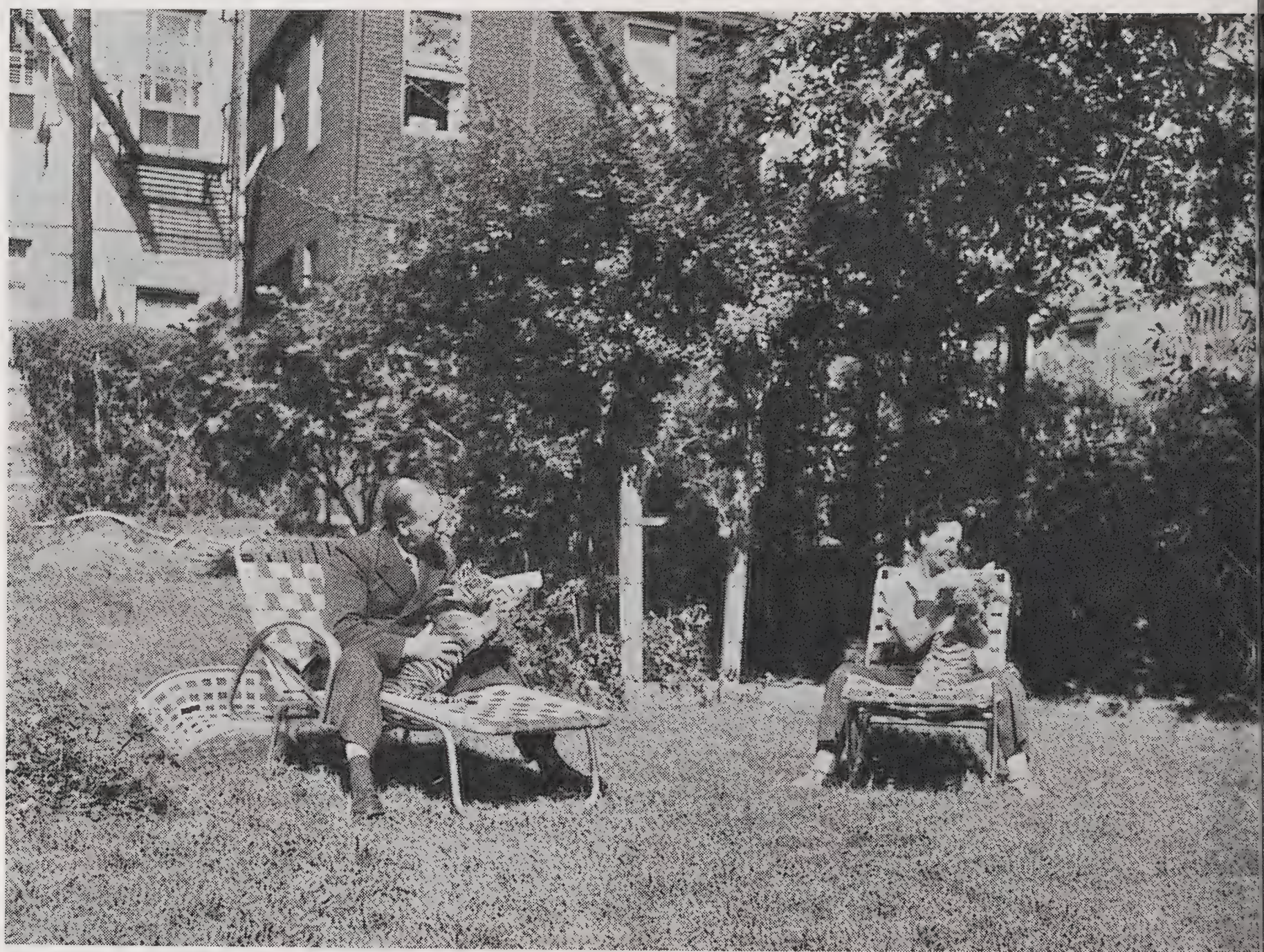
No **DUCKBILL PLATYPUS** baby this year! Early in August the bank of earth at one end of our Platypusary was opened — after all hope had been abandoned that Cecil and Penelope would produce offspring this season — and this meandering tunnel was found. The Platypuses were observed courting for the first time on June 16, and courtship continued with a good deal of fervency for nearly a month. Penelope paid no attention to the eucalyptus leaves that were put into the water of her pool, and when courtship stopped and she gave none of the signs of nest-building, we decided that once again the Platypus affair was coming to nothing. Whether the animals will be beyond breeding age next spring, when they will have been ten years in the Zoo, is unknown, but they will be given every chance. They came to us from Australia in April of 1947. White sand has been poured on the floor of the tunnel to emphasize it.

is **GRANT'S ZEBRA** colt, born in the Zoological Park on August 19, will be sticking close to its mother for some time yet, but it is likely to have a larger circle of acquaintances next year. We are thinking of introducing it to the African Plains exhibit, where it will have the companionship of young Zebra named "Jesse," given the run of the plains this past year. The new colt is the first born to our pair of Grants. The father came to us from the Tanganyika region of Africa in 1952.



For the second time we have a **KORI BUSTARD**, a large and handsome bird from South Africa, which has not been seen in the Zoological Park since 1944. An insect-and-greenstuffs feeder, the Kori is much hunted on the African plains and is a wary and difficult bird to stalk. In the Zoological Park, its difficulties are of a different order; it is notoriously fragile and must be handled with the greatest care to prevent the breaking of legs or wings — or, better, not handled.

Castor and Pollux, the **TIGER CUB** twins born to Dacca, our prolific Tiger mother (they are her 26th and 27th offspring) have been having a wonderful summer. Because it was necessary to remove them from their mother soon after birth, they have been hand-reared by Mrs. Helen Martini in her home and garden near the Zoological Park. With a large yard to roam in almost at will (under Mrs. Martini's watchful eye, of course) they have developed into strong and sturdy youngsters. On five afternoons a week during the summer they have been fed in public by Mrs. Martini, in the north outside bay in the Lion House, but now that they are four months old, they are big enough to go on regular exhibition by themselves. They will not, however, be with their mother.





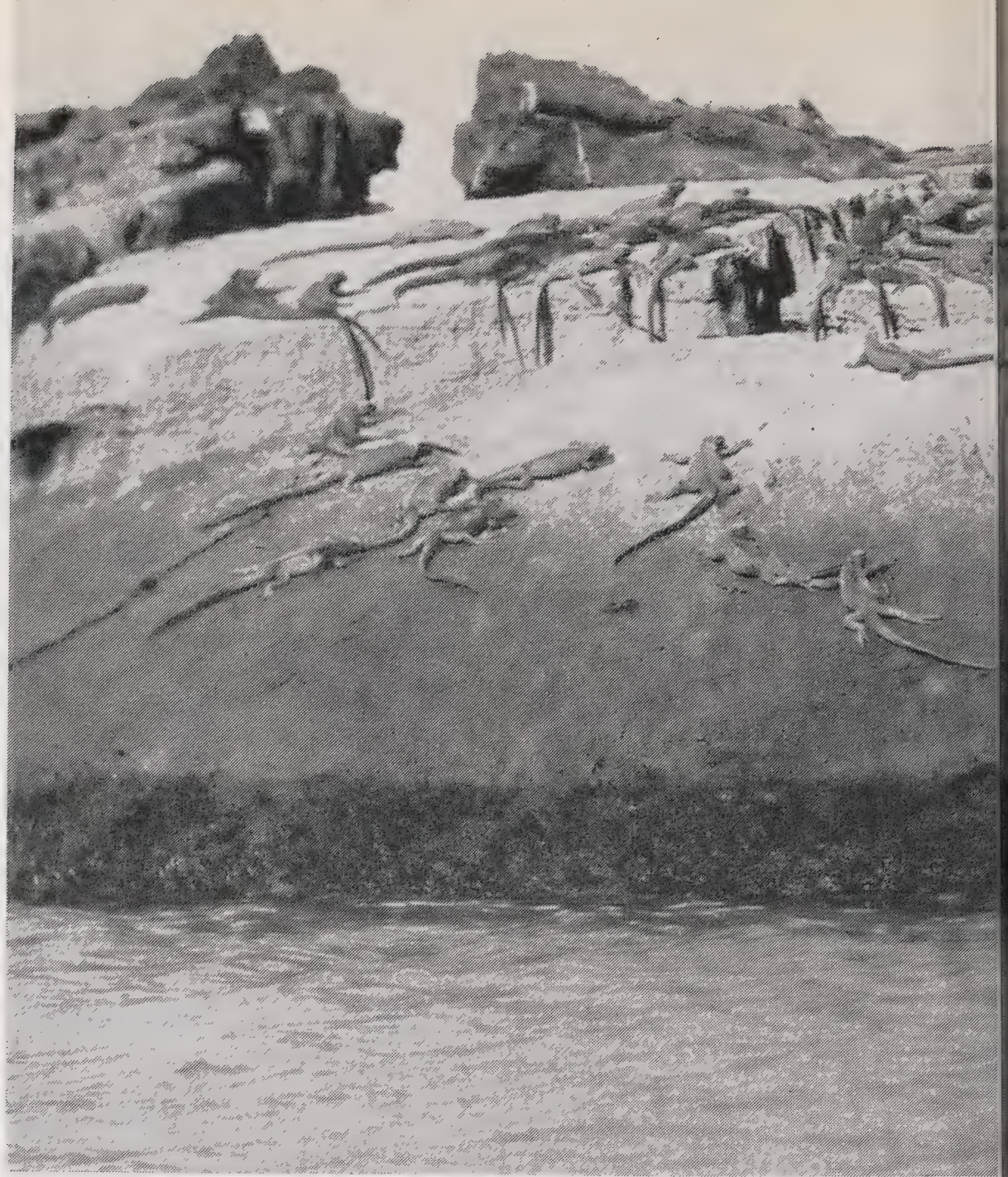
LIZARDS OF THE SEA

By JAMES A. OLIVER

WHEN CHARLES DARWIN VISITED the Galapagos Islands in 1835 he met one of the world's most unusual assemblages of animals and plants — organisms that contributed substantially to the formation of his theories of evolution and thus made a lasting impact on the thoughts of man. One of the most bizarre forms he encountered was the Marine Iguana (*Amblyrhynchus cristatus*), the only living lizard adapted for life in the seas.

In the account of his visit to the islands Darwin wrote:

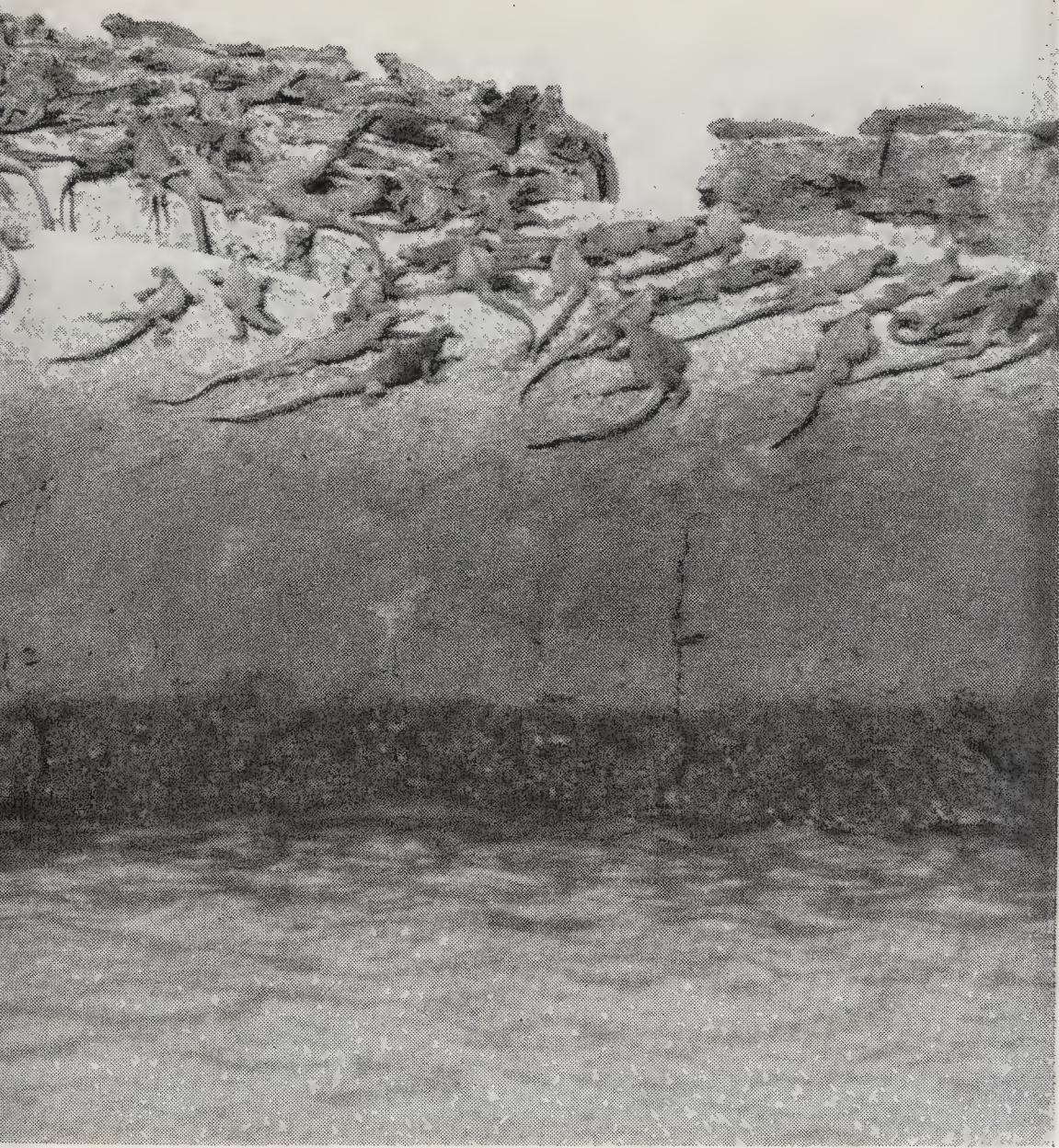
"It is extremely common on all the islands throughout the group, and lives exclusively on the rocky sea-beaches, being never found, at least I never saw one, even ten yards in-shore. It is a hideous-looking creature, of a dirty black colour, stupid, and sluggish in its movements. The usual length of a full-grown one is about a yard, but there are some even four feet long; a large one weighed twenty pounds: on the island of Albe-marle they seem to grow to a greater size than elsewhere. Their tails are flattened sideways, and all four feet partially webbed. They are occasionally seen some hundred yards from the shore, swimming about; and Captain Collnett, in his Voyage, says, 'They go to sea in herds a-fishing, and sun themselves on the rocks; and may be called alligators in miniature.' It must not, however, be supposed that they live on fish. When in the water this lizard swims with perfect ease and quickness, by a serpentine movement of its body and flattened tail — the legs being motion-



less and closely collapsed on its sides. A seaman on board sank one, with a heavy weight attached to it, thinking thus to kill it directly; but when, an hour afterwards, he drew up the line, it was quite active."

Darwin's account provides a good introduction to this interesting lizard, although his description of it as "a hideous-looking creature" suggests a personal antagonism to reptiles. Much more sympathetic is William Beebe's designation, "these splendid saurians." Whether you go along with Darwin on the appearance of the Marine Iguana or whether you share Beebe's more cordial feelings, I think most of us can agree on the uniqueness of these lizards.

William Beebe, John Tee-Van and other members of the Department of Tropical Research's *Noma* Expedition arrived at the Galapagos Islands almost a century after Darwin's visit. They, too, were impressed by these marine reptiles, so much so that they collected a number of them and brought them back to the Zoological Park where they were exhibited at the spring Garden Party of 1923. From his experiences with the lizards Dr. Beebe wrote, "I discovered two very interesting things about them — they could not be made to bite, and they absolutely refused all food in captivity." It has been more than a quarter of a century since these remarks were made, but their accuracy remains unaltered.



ABOVE — Large numbers of Marine Iguanas may be found basking on this favorite ledge in Webb Cove, Albemarle Island. **RIGHT** — A sooty black Marine Iguana received recently.

Failure to induce the lizards to eat in captivity is not the result, as it sometimes is, of a lack of knowledge of their natural food. Darwin, Beebe and others have made first hand observations on their feeding habits. Darwin wrote, "I opened the stomachs of several, and found them largely distended with minced sea-weed (*Ulvae*) which grows in thin foliaceous expansions of a bright green or a dull red colour. I do not recollect having observed this seaweed in any quantity on the tidal rocks; and I have reason to believe it grows at the bottom of the sea, at some distance from the coast. If such be the case, the object of these animals occasionally going out to sea is explained. The stomach contained nothing but the seaweed." Dr. Beebe observed on Indefatigable Island that "when the water began to recede they crawled slowly down and munched at the tufts of exposed sea-weed."

Mr. Otis Barton, designer of the Bathysphere and a longtime associate of the Society, recently sent us three excellent young specimens of Marine Iguanas, the first we have had in many years. Since their arrival we have been trying to disprove Dr. Beebe's statement about their re-

fusal to eat in captivity. To date his statement continues to be true, but we have not given up hope and still have several ideas to try on them. It is always a challenge to overcome an individual's reluctance to eat in captivity. It is more so when this reluctance appears to hold for all or most members of a species. So far we have offered the lizards what seemed to us appetizing — both in looks and smell — salads of several kinds of sea-weeds, with and without chopped and whole clams. These offerings have been presented in and out of salt and fresh water. Something is still lacking — perhaps a characteristic odor, color, shape or consistency of some normal food substance. Or, perhaps, we are not presenting the food in just the right manner. All too often with finicky feeders, it is a matter of some slight circumstance we may learn about only by accident,



but which is necessary to release the feeding response that stimulates the animal to eat. Meanwhile the three Marine Iguanas are on exhibition in the Reptile House and are attracting considerable interest. They do not show any external effects of their prolonged fast.

The Marine Iguanas have been studied most recently in their native habitat by Dr. Irenäus Eibl-Eibesfeldt of the Max-Planck Institute in Austria. Many previous observers have reported seeing the lizards in large herds of several hundred individuals. Eibl-Eibesfeldt found these

large herds were composed of many smaller herds, each of which consisted of one male and several females. The polygamous males maintain definite territories which they defend vigorously against the intrusion of other males. Dr. Eibl-Eibesfeldt says, "These fights are highly ritualized and follow certain rules. First the two males show a certain threatening behaviour, then they try to push each other off the rocks, using their heads." The top of the head is covered with raised, knob-like scales that are supported beneath by bony nodules on the skull. Occasionally when a male enters another's territory without the preliminary butting and pushing, the defending male may bite the intruder. Otherwise biting is seldom used in these fights. Eibl-Eibesfeldt found that males stay close to their territories when on land and return to them if forcibly removed.

Darwin performed a simple experiment with one of the lizards which also suggests a good sense of orientation in the water. He wrote, "I threw one several times as far as I could, into a deep pool left by the retiring tide; but it invariably returned in a direct line to the spot where I stood. It swam near the bottom, with a very graceful and rapid movement, and occasionally aided itself over the uneven ground with its feet. As soon as it arrived near the edge, but still being under water, it tried to conceal itself in the tufts of sea-weed, or it entered some crevice. As soon as it thought the danger was past, it crawled out on the dry rocks, and shuffled away as quickly as it could. I several times caught this same lizard, by driving it down to a point, and though possessed of such perfect powers of diving and swimming, nothing would induce it to enter the water, and as often as I threw it in, it returned in the manner above described."

The Marine Iguana belongs to a large family of lizards known as the Iguanidae. Most members of this family are small to moderate in size, but of the 60 to 65 genera comprising the family at least six include forms nearly as large or larger than the Marine Iguana. All of these large forms are known as iguanas. The word itself is a Spanish term of Indian origin and is generally applied throughout Latin-America to any large lizard. Probably the best known iguana is the large, green, tree-dwelling species usually called the Iguana, the Common Iguana or Green Iguana

and whose scientific name is *Iguana iguana*. It is from this species that the family name is derived. The Green Iguana is a suitable standard bearer for the family. It attains the greatest length of any member of the family, with maximum overall dimensions of six to seven feet. The long, whip-like tail takes up most of this length. The Green Iguana is found in wooded areas, generally near water, from Mexico to and including South America and the West Indies. These large lizards are hunted for food over most of this area and are seen frequently in native markets where they usually are called "chicken of the tree." They also are sold alive in large numbers to carnivals and reptile shows where they are exhibited as "Chinese dragons." The row of long, spine-like scales along the middle of the back and the large dewlap on the throat enhance the impressive appearance of this lizard.

The Green Iguana, like its marine relative in the Galapagos Islands, is an excellent swimmer, but it confines its activities to freshwater rivers and swamps. It feeds on leaves, blossoms and succulent seeds of plants. The adults are usually seen in large trees, often on limbs overhanging water. When pursued, wounded or disturbed they have been known to jump or dive from great heights. When landing in water, they swim away rapidly, usually underwater. The powerful tail propels them through the water and the legs are not used in swimming. Iguanas can remain submerged for long periods of time.

All of the large iguanas can swim well when occasion demands, but the Marine and the Green are the best swimmers. In light of these abilities it is interesting to note the difference in the behavior of the two forms. Many observers have reported that it is almost impossible to drive the Marine Iguana into the sea and that they enter the water only on their own volition. Apparently they had no enemies on land until man came along to disturb them, and sharks and other marine predators constituted their main danger. The Green Iguana, on the other hand, heads for the water as soon as it is disturbed — to it the water represents safety when danger approaches.

In addition to the Marine Iguana there are two large land-dwelling iguanas on the Galapagos Islands. These are stockier species and live inland in burrows among the rocks and low trees of the

The Green Iguana is the longest of its family, reaching a length of six to seven feet. This one was a pet in our Reptile House.

Photo Jack Layer, Journal-American



islands. The better known of the species is called the Galapagos Land Iguana (*Conolophus sub-cristatus*). In the West Indies there are several species of land iguanas, the largest being the Cuban Iguana (*Cyclura macleayi*), which is very heavy bodied and may attain a length of four or five feet. It is probably the heaviest of the iguanas, sometimes weighing more than 30 pounds. The Rhinoceros Iguana (*Cyclura cornuta*) of Hispaniola is the most impressive-appearing of the West Indian species. It gets its name from the prominently raised, horn-like scale on the snout.

The Spiny-tailed Iguanas of the genus *Ctenosaura* occur from northern Mexico to Panama. The several species are mostly under three feet in length. Their common name comes from the rows of spine- or spike-like scales that arm the tail. All of the big iguanas can use their tails as effective defensive weapons. The long whip-like lash of the Green Iguana can raise a painful welt on the arm of a man or can knock over a small predator. Similarly the spike-covered tails of the Spiny-tailed Iguanas can painfully lacerate the nose of a would-be mammalian predator.

All of the large iguanas mentioned so far are forms living in the tropical and subtropical areas of the Western Hemisphere. The family Iguanidae consists almost entirely of forms found in

the Americas. The animals and plants of the Galapagos Islands are related to species in Central and South America and therefore the islands are considered in the American area. The only members of the family living outside of this area are found in Madagascar, Fiji and Tonga. The seven species on Madagascar are all small forms, but the one on Fiji and Tonga is a good sized iguana, reaching a length of two to three feet and is known as the Fijian Iguana (*Brachylophus fasciatus*).

The stories of how the iguana got to Fiji and Tonga, or why the family is found on Madagascar but not in Africa, are interesting zoogeographic considerations too complex to relate here. Simply stated, the history of the Iguanidae goes back more than 60 million years and the fossil record shows the family was once more widely distributed. Its representatives in the Old World have become extinct except for the small remnants on Madagascar and the Fijian Iguana, also living on islands. Islands seem to have provided suitable sanctuaries for these large lizards. Four of the six groups of large iguanas living today are found on islands. Among these, the two from the Galapagos have had special interest for herpetologists and zoogeographers, but the Marine Iguana remains the most unusual and interesting of all.

THE AMERICAN BEAVER

(Part 2)

By ALBERT R. SHADLE

Biology Department, University of Buffalo

IN STARTING a new home, Beavers must be assured of a plentiful water supply, such as a lake, a big pond or a stream. Where there is an abundance of deep water, it is unnecessary for them to build dams. In small streams and brooks, they must build up dams which will store and conserve the water so that there is an adequate amount throughout the year, and particularly in the fall and winter. The water must be deep enough for the storage of a winter's supply of food and too deep for the pond to freeze solid in the most severe winter weather.

If the new home is in a small stream where a bank den can be built, the construction of the dam and the den will usually be carried on simultaneously. The easiest and quickest way for the Beavers to build their living quarters is to dig a bank den with two or more burrows leading from it for entrance and escape. This is possible when the bank beside their lake, pond or stream rises four or more feet above the level of the water. The site chosen is usually among roots of shrubs or a tree standing on the bank.

A foot or more below the surface of the water, the Beavers start to dig a burrow back into the soil and any roots that they encounter are promptly cut off with their incisor teeth and removed. The burrow or tunnel is extended several feet into the bank and sloped upwards until it is several inches above the level of the water which rises in the burrow to the same height as that in the pond outside. At the dry upper end of the tunnel, a larger cavity or den space is excavated for living quarters. This room is probably about four feet or more in diameter and fifteen to eight-

een inches in height. After their nocturnal work and other activities, the Beavers are safe here from the attacks of other animals and can rest and sleep in the daytime, for the entrances are always below the surface of the water and few animals would dive down and follow the water-filled tunnels to get up into the living quarters.

When the construction of a dam is begun, brush and pieces of limbs of various kinds, sizes and lengths are cut and dragged or towed to the building site and located in the stream. The Beavers also carry mud, wet leaves, pieces of sod, moss and other materials. As these are gathered up, they are firmly pressed against the Beaver's



breast by its fore legs and paws. When carrying mud, etc., to place on the brush, the Beaver can often swim with it, but if the water is too shallow to swim, it walks along semi-erect to the dam where the mud or other soft material is placed so that it fills in the spaces among the limbs and brush. More and more "arm-loads" of the soft materials are brought, additional brush and pieces of limbs are added, and more mud is filled in to solidify the structure and to prevent the dam from leaking.

As the structure begins to hold back the stream, the water rises and spreads, forming a Beaver pond by the den. As the water continues to rise and starts to flow over the dam or around its end, the Beavers promptly bring up more sticks and mud which lengthen or raise the dam and also stop the loss of water.

Most of the mud and other soft materials, such

as leaves, weeds, roots, etc., used to chink the interstices, are dug from the bottom of the pond and this excavating deepens the pond and gives space for greater storage of water. As the Beavers gradually raise the crest of their dam and widen its base, they take advantage of each slight rise in the ground, of old logs, big stones, fallen trees, or anything else which can be incorporated in the dam. The gradual increase in the height and length of the dam holds back more water and the pond deepens and spreads over a larger area. As the water rises in the pond, it also gradually rises in the burrows and this brings about reactions from the Beavers.

Dens in low banks often go through an interesting series of modifications which materially change the surroundings and result in the successive transformation of the den from a simple "bank den" to a "bank lodge" and finally a lodge

completely surrounded by water, an "island lodge." This is all due to the damming and the rise of the water level in the pond. These modifications occur somewhat as described below.

When the rising water in the bank burrows threatens to flood the living quarters and the remaining soil of the den roof is too shallow to permit further excavation of the roof without thinning and weakening it too much for safety, the Beavers begin to convert the bank den into a bank lodge. They carry sticks, limbs, mud, etc., up on the bank and place them directly above the den, thereby thickening the roof very appreciably. Sometimes a cone-shaped pile two or more feet in thickness is built above the den. With this additional roof protection, the Beavers begin to dig away the remaining soil of the roof, allowing the dislodged material to drop to the den floor. Thus by digging away the ceiling and adding the material to the floor, they gradually build up the floor level of the living quarters by several inches. When all the original roof is dug away and they begin to encounter some of the sticks and mud they have previously piled over the den, part of that mud, too, has to be dug loose and protruding portions of the embedded wood have to be gnawed away and dropped as chips. These also become a part of the floor and the basal portion of the lodge. With the pilings of the additional ma-

A typical "island lodge." Fresh cuttings have been dragged in to make the lodge, and a coating of mud and leaves will be added.

Photo by R. D. Fraser

This Beaver dam in the Allegheny State Park is an especially big one. It is 470 feet long, 7 feet high, is built mostly of aspen.

Photo by R. D. Fraser



terial over the den and its excavation to form living quarters, the original bank den is now properly termed a "bank lodge."

Continued gradual rise of the pond level necessitates the addition of more and more material to the outside of the bank lodge and the excavation of the inside of the pile. Masses of material may be built up in a pile six feet or more high above the original bank, and may be twenty or more feet in diameter. The raising and lengthening of the dams sometimes deepens and extends the water until it completely inundates the area around the bank lodge, so that the lodge appears simply as a cone-shaped island in the pond. The lodge now may properly be called an "island lodge," a type which is usually found in low swampy areas and in ponds lacking well-defined banks high enough to provide bank lodges.

The length and height of a dam depend upon several factors, some of which are the topography of the immediate surroundings, the slope and width of the valley at that point, the size of the stream, the volume and depth of the water, and the sizes, kinds and abundance of trees and woody shrubs available close by. Dams vary in length from a few feet to more than a thousand feet, while the heights range from a few inches to eight feet or more.

Long dams and high ones require a very considerable amount of wood to make them strong enough to hold water during the heavy flow in the spring, or after a heavy rainfall. The Beavers must fell the bushes or trees, cut them up into sizes and lengths which they can handle and drag overland to the water where they can be towed to the building area and used. The size and length of the cuttings depend upon the weight and strength of the animal, the weight of the wood and the nature of the terrain over which the cuttings must be dragged and towed.

In the summer of 1951, measurements were made of 140 of the larger cuttings in an old Beaver dam in the Allegany State Park in southern New York. The longest piece was a 20-ft. 7-in. sugar maple, 2.16 inches in diameter at the base. The longest aspen section measured 13 feet 5 inches with a diameter of 3.75 inches. The longest blue beech was 9 feet 7 inches in length with a diameter of 3 inches. A 3.5-inch shadbush log was 9 feet 10 inches long and a single large

elm found was 9 feet 4 inches in length with a 3.75-inch diameter.

The largest diameters were: an aspen, 6.37 inches, length 3 feet 6 inches; shadbush, 5.75 inches, length 6 feet 10 inches; blue beech, 5 inches, length 6 feet 5 inches; maple, 4.75 inches and length 11 feet 6 inches.

These measurements were made from old, seasoned, barkless wood, and it would be interesting to know what the measurements were at the time when the Beavers made the cuttings, when they were green and before the bark was removed. Naturally the diameters would have been greater and the weights considerably heavier. Such figures would also give a more adequate idea of the ability of the Beaver to handle large-sized, heavy pieces of wood.

The Beaver's heavy skeleton and the powerful muscles of the jaws, neck, limbs and body enable it to exert remarkable force in drawing, towing or handling wood cuttings. The little hand-like fore paws and strong shoulders are well adapted for pushing and turning and manipulating the cuttings where they are needed in construction. This is especially important when the Beavers are repairing a break in the dam. The large teeth and heavy neck are also quite useful in placing and anchoring a piece of wood in building or repairing.

To repair a break, the Beaver chooses a piece of wood and takes it to the dam. With its big incisors, it seizes the stick crosswise about six or eight inches from the end. It lowers its head and gives the head and neck quick strong jerks to one side, so that the short end of the stick is jabbed several inches into the wet mud around the break, thereby being anchored firmly in position. The surrounding part is then filled in with more pieces of wood, and finally chinking material is added to stop the flow of water through the opening.

When it uses long poles, the Beaver tows them to the dam, where they are dragged over the crest and left with the upper ends resting on or against the crest, and the lower ends stuck firmly in the mud below the dam. The tops of these long poles eventually become buried in the face of the dam as it is built higher. In this way they serve as props which strengthen the structure. They often measure two to four inches in diameter and six to ten feet or more in length. These pieces of heavy



These two remarkable photographs are probably the first ever published of a Beaver carrying its young in its arms. They came to us through the kindness of Dr. H. Hediger, Director of the Zoo in Zurich, Switzerland. He wrote: "Last June we succeeded in breeding young Canadian Beavers in our Zoo, and we often observed that both of the parents carried the young back to the nest in their arms when the young had been in the water long enough. In the older literature we found two references to this habit, but I have never seen any photograph of this interesting behavior." Note that the adult Beaver makes a rack or cradle of its outstretched forelegs, and that the paws are turned outward. The animal walks more or less upright with its burden, as it would when dragging a tree section to its lodge or dam.

Photos by Werner Haller

Zofingen (Aargau), Switzerland



wood on the lower surface of the dam break the force of any water which spills over the crest, thus lessening and retarding the wear on the lower face of the dam.

Sometimes the Beaver's need for building material may be so urgent that it takes the freshly cut limbs directly to the dam and uses them without removing the bark for food. It is quite common to find long pieces of fresh green willow limbs partially embedded in the lower face of a Beaver dam. In spring, these green limbs, kept fresh by the wet mud, grow like cuttings. Roots sprout and grow into the mud, buds begin to swell along the exposed bark, and soon willow shoots are growing up on the face of the dam. However, sooner or later a hungry Beaver finds and devours these lush growths.

When the land is marshy or flat and no high ground is available for a bank den, the Beavers are forced to build a pile of wood and mud on the floor of the pond, stream or marsh, and tunnel into it to make their living quarters. During the construction of such an "island lodge" they take advantage of any cover or protected places to live until their new home is built. Having chosen the site for their new quarters, they begin to cut and bring together some of the surrounding vegetation and pile it into a heap. Almost anything at hand is used — freshly cut materials from bushes and trees, dead limbs, pieces of rotted logs, grass, sod, moss, aquatic vegetation, mud and even stones. As this mass begins to rise above the level of the water, more and more materials are added until it may extend four or more feet above the water level. By the time the pile is well above the water line, the Beavers begin a foot or more under the water to burrow up into the mass. When they have dug and gnawed their burrow up into the materials, until they are well above the level of the water, they enlarge the upper end of the burrow into a good-sized room which is used for general living quarters and for resting and sleeping when they are not active. These quarters may have two to four or more entrances, depending upon the size of the lodge and upon the number of resident Beavers, which may range from two to ten or more.

In low, wet areas, where the water level is near the surface of the ground, the Beavers may dig canals two feet or more wide and probably a foot

to fifteen inches deep. Since these are used in transporting materials, they may become a part of, or the terminus of, a tote road. Canals are built largely by means of the Beaver's long-clawed front paws with which the soil and vegetation are dug loose and either pushed or carried aside until the desired amount of water stands in the canals. They are often so well done that they look almost as if they had been made by man. They may or may not be deep enough for the Beaver to swim in them, but they are a means of travel, and they also serve for the transportation of materials. They vary in length from a few feet to several hundred feet, and may be especially useful during the period of cutting and storing of food in the late summer and autumn.

In the spring, the Beavers begin to search out and cut bushes and trees for a diet of fresh twigs and bark, and as the leaves begin to grow a little later, they too are eaten. Such trees include in order of preference, the aspens (and other poplars), willows of various kinds and birches, but maples, wild cherries and several others are also taken. In southern New York State, shadbush and blue or water beech are used in considerable quantities, and alder may also be used. The bark of evergreens, such as hemlock and various pines, is used sparingly in that area.

As spring advances and grasses and aquatic plants become plentiful, the Beavers also turn to these for food. During the late spring and summer these may become major food items, even though twigs, bark and leaves remain staple foods. During the late fall when the deciduous leaves have fallen, and throughout the winter, their food consists of the bark of twigs and branches stored under the ice-covered water of the Beaver pond. Here in the water, and later under the ice, the bark on the twigs and branches remains reasonably fresh.

When aspen is cut down in the summer, the Beavers cut off the limbs and drag them, leaves and all, to their stream or pond. Under water, they will stay fresh for several day. The Beavers like to sit in the water while they feed, so in the evening they cut off a small branch and carry or tow it into shallow water. Sitting there half submerged, they grasp the leaves in both fore paws and push them into their mouths with a short, quick, jabbing motion. The incisors rapidly snip

the leaves into small bits and the flat-crowned molar teeth thoroughly grind each mouthful before the pasty mass is swallowed. When the tips of the twigs are soft and green, they too are often cut into bits and the bark and the wood chewed up together and swallowed. However, when the twigs are older and larger, and there is too much wood in them, they are cut into lengths of a foot or more for the removal of the bark. Holding such a piece of twig with both front feet, the Beaver begins to gnaw the bark from the wood. As it is nipped off, the Beaver rolls and pushes the twig across the front of its incisors like a man eating an ear of corn. The facility with which the fore paws turn and manipulate such a piece is really remarkable, and is fascinating to observe.

When the bark has been completely eaten, the peeled twig is dropped. The bark may be removed from limbs and trunks which are several inches in diameter, but when it has become too tough and corky, the Beavers do not use it for food. Usually the trunks and limbs which have this very corky bark are also too large in diameter for them to handle, so those portions of the tree are allowed to lie as waste, to rot down, and again form soil.

An active Beaver colony is always evident. Freshly peeled sticks and limbs can be seen long before you are close enough to observe tracks on the piles of fresh mud where they have been working on a dam.

(To Be Concluded)

News from the Conservation Foundation

Conservation Teaching Manual Is Being Tried Out

A completed draft of the Conservation Foundation's new 400-page manual, "Teaching Science through Conservation," was presented to a large cross-section of elementary and high school teachers at teacher workshops at Antioch and elsewhere in the nation during the summer, for their consideration and comment. This manual, prepared by Martha Munzer and Paul Brandwein of the Educational staff, was received with unprecedented enthusiasm by the science teachers and will now be developed for publication.

Water Law Symposium

Forty experts in water law and water administration from eastern and western states, together with a dozen key observers, are convening in Washington from October 3 to 6 to review the need and methodology for fundamental changes in eastern state water laws, in view of the greatly increased and competing demands for water by communities, industries and agriculture. Stephen Bergen and David Haber of the Research staff have completed two years of preliminary investigation and have selectively assembled more than a thousand pages of expert analysis of the ripari-

an and appropriations doctrines on the rights of users. These, as well as an alternative approach of their own, have been submitted for discussion. Sixteen eastern states have appointed legislative commissions to study the need for modernization of water laws. Dr. Fairfield Osborn will personally greet the participants and emphasize the significance of the occasion.

Whitefaces and Blacktails

Dr. Carl Koford has completed the manuscript report of his findings on the ecological relationship of prairie dogs to ground cover and cattle on the western range land. The title is "Whitefaces, Blacktails and Blue Grama." The study was jointly sponsored by the Zoological Society and the Foundation.

New Chair of Conservation

Anonymous donors have endowed a new Professorship and Chair of Conservation at the University of Louisville in honor of Thomas Wallace, editor and crusader for the better use of all of our natural resources. The endowment totals \$235,000. Dr. Osborn has been asked to serve as a member of the advisory committee appointed by the President of the University.

New Jamaica Project Activated with British Support

A new and enlarged project, designed by Robert Snider, for extensive studies of human behavior and economic and human needs to balance population demands and resource supply on the island of Jamaica has, in addition to funds from sources in the United States, acquired the support of the British Colonial Office and the Nuffield Foundation of England.

Dr. J. M. Stycos, who conducted our earlier Jamaican studies, and Dr. Kurt Back have begun the training of local research workers. Interviews in many parts of the island are already under way. It is expected that the results of this

training and the methods evolved from the project will cause additional resource and population studies in other Crown Colonies to be initiated.

Industrial House Organ Features

A series of twelve illustrated cartoon-style "features" has been distributed to nearly five hundred industrial house organs for free use in these publications which reach an estimated million or more readers. Each unit deals with some aspect of the earth's natural resources and their relation to man and his prosperity. The complete series, each unit measuring 4 by 5 inches, is available to any "general interest" publication on request.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Quentin Melling Schubert

Quentin Melling Schubert, Superintendent of Construction and Maintenance at the Zoological Park since 1944, died on August 25.

In the past twelve years Mr. Schubert supervised construction and improvements totalling more than \$2,000,000 in the Zoological Park. His major jobs were the Penguin, Small Mammal and Great Apes Houses, reconstruction of the Reptile House and remodeling of the Wildfowl Pond, but his principal problems were the thousands of routine work orders that flowed into his department for execution, and on which the appearance and smooth operation of the Park depended.

Mr. Schubert, through his work and character, has left a lasting mark on the Zoological Park and will be sorely missed by his associates and his friends in the Zoological Society.

The Aquarium Will Be Ready for Occupancy Soon

The "first unit" of Stage I of the new Aquarium at Coney Island went into operation on August 1 when the Parking Lot was opened for business. Last minute construction problems that must be ironed out before the building is formally turned over to the Zoological Society have delayed occupancy and the actual beginning of "housekeeping," but the end is not far off and we are still planning the opening of the new institution for next spring.

Marco Polo Sheep Exhibited for First Time Here

A trio of Marco Polo Sheep, *Ovis poli*, arrived early in September and are now on exhibition at the south end of Mountain Sheep Hill. They are the first of these rare and large sheep we have ever exhibited. The two females and a male made themselves at home quickly and it is hoped that they will eventually establish a breeding colony. They are about half-grown. All we know about their background is that they came from the Prague Zoo, and that presumably they were captured in the Russian Pamirs when very small.

A Correction

On Page 106 of the July-August issue of ANIMAL KINGDOM, the length of a very large Mexican Bearded Lizard in the San Antonio Zoo was stated to be nearly twenty inches. The correct length is 780 mm., or about 30¾ inches.

IN BRIEF

No Sale. Komodo Monitors are, apparently, a good investment. We were recently offered \$5,000 each for our monitors, which have been in the collection a little more than a year, but the offer was promptly and emphatically declined. They are the only Komodo Monitors on exhibition outside their native islands, and in the last few months they have been feeding voraciously and putting on weight and bulk.

Photographic Honors. Staff Photographer Sam Dunton was made a member of the Fellows Committee of the Biological Photographic Association of America at its Rochester meeting in August. His motion picture, on the reproduction of the King Cobra, was greatly praised.

Those Questions! Among recent questions asked (in all seriousness) at Question House were:

What are coyotes made of?

Why do cats eat birds?

Where is the Mozapus?

Do Giraffes have fingernails?

When was the Missing Link found?

From the Galapagos, via Florida. In 1928 when the late Dr. Charles H. Townsend went to the Galapagos Islands to form a collection of Giant Tortoises, it was planned to establish breeding colonies in Florida, Bermuda and elsewhere in sub-tropical climates. Various disasters intervened — a hurricane that wiped out some of the colonies in Florida, among others — and over the years a few tortoise eggs hatched, seven in Bermuda and two in Florida. Only one of the two Florida tortoises survived more than about ten years, and now it has come to us. Seventeen years old, it weighs 107½ pounds and is apparently in flourishing health. It came to us from Mr. G. F. Sirman who for many years operated the North Miami Zoo where the last colony of Galapagos Tortoises was maintained.

Education Department Story. The November issue of *National Geographic Magazine* will contain a well-illustrated article by Miss Marion McCrane of our Education Department on her “travelling zoo”—the small animals she takes to schools and hospitals.

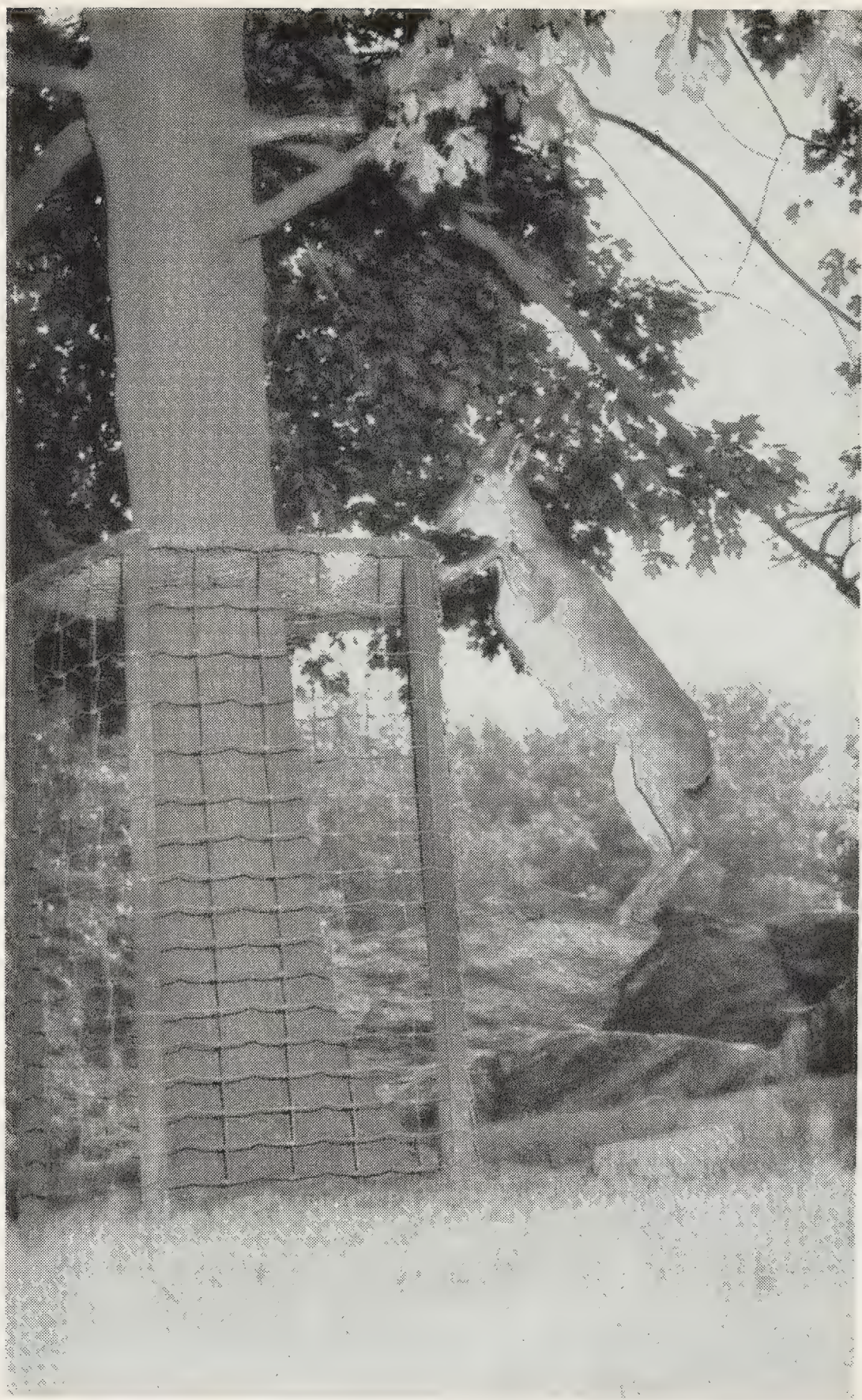


Photo Arthur Sasse, International News Photos

No sign of a broken leg here! This athletic animal is our male Markhor which broke one of its forelegs while jumping around the walls of its compartment in the Federal Quarantine Station last winter. The leg healed perfectly and all summer the animals (we have a pair) have been amusing visitors by their antics on the tree guard in their yard. If the female is on the tree guard when the male wants to perch, she often leaps up in the tree and walks out on surprisingly small limbs, jumping down from a height of ten or fifteen feet. The animals are exhibited on Mountain Sheep Hill.

Big White Owl. Always on the alert for rare, strange or otherwise interesting specimens, our Bird Department sifts its telephone calls and letters carefully, and birds that would represent unwanted duplicates are politely declined. But descriptions are often unintentionally misleading and it is sometimes difficult to determine whether a “big brown bird with a long beak” is just an-

other local Black-crowned Night Heron or something more desirable. However, when a lawyer telephoned from his office in Hoboken and said he had in a box a "big white owl that stood two feet tall," we sent for it, confident that it was a Snowy Owl making an unusually early appearance in this area. While the American Barn Owl that arrived as a result of this call was scarcely white or two feet tall, it was nevertheless welcome as we had not had the species since 1946.

Hummers to London. For the past sixteen years the month of September has never passed without at least one, and often several, Ruby-throated Hummingbirds being acquired as a result of difficulties they had gotten into on their migration southward. The past month was no exception and the first Hummer, a female, was brought in by a Bronx resident on September 7. We already had a male and since we had promised a pair to the London Zoo, they left for England a few days later.

Phoebe II. The young Hippopotamus named Phoebe, which came to us on July 2, 1953, as a companion to Peter II, died in July as a result of septicemia (which, mysteriously, did not attack her mate in the same compartment). We have now obtained a replacement, Phoebe II, which came on August 30 and weighed 690 pounds. Although less than half the weight of her companion, Phoebe seems to have a will and a temper of her own, and is not being dominated by the larger male.

PUBLICATIONS OF INTEREST

SPRING ON AN ARCTIC ISLAND. By Katharine Scherman. 331 pp., 16 illus., map end-papers. Little, Brown & Co., Boston, 1956. \$5.00.

Members of the Zoological Society will recall the "advance copy" of Miss Scherman's book they received at the Society's mid-winter meeting in January of 1955. At that meeting she showed a motion picture, "Spring in the Arctic," and talked engagingly about the birds, the flowers, the mammals and the people she encountered on an expedition to Bylot Island — an expedition sponsored by the Zoological Society and the Arctic Institute of North America. As Miss Scherman talks, so she writes: easily, graphically, with the small, revealing detail that makes the life of Eskimos and white men in the Far North very real for those of us in warmer climates. There were dangers and emergencies, but they are not over-played. "Spring on an Arctic Island" is entertainment, but a good deal more than that; Miss Scherman asked questions and looked under the surface of things wherever she went. — W. Br.

AN ATLAS OF ANIMAL ANATOMY FOR ARTISTS. By W. Ellenberger, H. Baum and H. Ditttrich. Second revised and expanded edition. 153 pp., 288 illus. Edited by Lewis S. Brown, Exhibition Dept., A.M.N.H., New York. Dover Publications, Inc., 1956. \$6.00.

This handsome volume contains all plates from the standard Ellenberger, Baum and Ditttrich work on animal anatomy with 25 additional plates by other anatomists.

The superb drawings show the exterior aspect of each animal, its muscular arrangement and its skeleton viewed from the side, front and rear in various actions and in details. Fourteen species, all mammals, are treated. A useful bibliography is included.

An excellent reference book for anyone interested in the subject, whether scientist or artist. — CARL BURGER.

New Members of the New York Zoological Society

(Between July 1 and August 31, 1956)

Patron

L. A. Atz

Life

George R. M. Ewing
Miss Rosemary Kenedy
Pieter J. Opdyke
Mrs. C. F. Roe Slade

Contributing

Miss Nancy Appel
Edward Marshall Boehm
David C. Clark
Dr. Albert J. Erdmann, Jr.
Mrs. T. R. Eskesen
Mrs. Edward Immerblum
George R. Puckhafer

Mrs. Mildred B. Scales

Mrs. Fred Slavic

Mrs. Philip A. Straus

Charles J. Symington

Louis E. Walker

Annual

John B. E. Allen
Miss Barbara Ellen Auerbach
Sidney Baer
Robert E. Barnard
Mrs. Edward A. Cunningham
Dr. J. Richard Czajkowski
Mrs. William J. Drohan
Mrs. Albert Edelman
Hal-Curtis Felsher
Andre Stephen Gorzka

Mrs. Annemarie Heller

Mrs. Oscar Howard

Miss Dale Krasnow

Victor A. Lang

Dr. A. A. Lazzarini, Jr.

Mrs. William M. Meredith

Ralph C. Mitchell

Eugene F. Moran

Dr. Robert H. Morris

Otto Ousteky

A. Brock Park

Edmund T. Ross

Mrs. B. H. Saunders

Mrs. Henry S. Sayers

Mrs. Abbot Southall

Miss Mary C. Wheelwright



Summer is over...

October is almost the loveliest month in the Zoological Park. The summer crowds have vanished and the pace of animals and people is more leisurely. This is the *best* time to see old favorites, and find new ones, before frosty nights drive them indoors.

The GIBBON FAMILY, for a little while longer, will still be swinging through the golden leaves on Gibbon Island

Perhaps you've seen the tree-climbing MARKHORS and the first-time-in-the-Bronx-Zoo MARCO POLO SHEEP in the newspapers. They're even more impressive, alive, on a sparkling October day

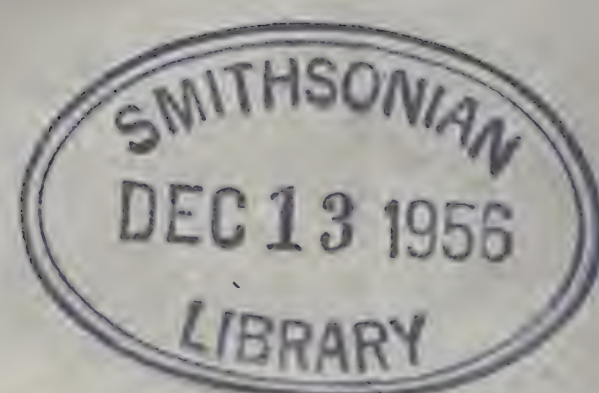
The KOMODO "DRAGON" LIZARDS are getting *fat* . . . Andy, the ORANG-UTAN, is *too* fat . . . the FLAMINGOES are in deliciously pink color now . . .

The list could go on forever. In short, do come to the Zoological Park this fall. And if you have friends who like animals as much as you do, send us their names on the postcard opposite. We'd like to send them information about our Zoological Society, and admission tickets for their next visit to the Zoological Park.

MEMBERSHIP COMMITTEE
The Zoological Park
New York 60, N. Y.



ANIMAL KINGDOM



NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT	VICE-PRESIDENTS	SECRETARY	TREASURER
Fairfield Osborn	Alfred Ely Laurance S. Rockefeller	Harold J. O'Connell	David H. McAlpin

EXECUTIVE COMMITTEE

Laurance S. Rockefeller <i>Chairman</i>	<i>Class of 1957</i>
George F. Baker, Jr.	Robert E. Blum
John Elliott	Percy Chubb, 2nd
Alfred Ely	C. Suydam Cutting
Robert G. Goelet	Alfred Ely
De Forest Grant	Childs Frick
David H. McAlpin	Henry Clay Frick
Robert Moses	David H. McAlpin
Harold J. O'Connell	Richard C. Patterson, Jr.
Fairfield Osborn	John H. Phipps
Edwin S. Webster, Jr.	Alfred G. Vanderbilt

BOARD OF TRUSTEES

<i>Class of 1958</i>	<i>Class of 1959</i>
George F. Baker, Jr.	Archibald S. Alexander
F. Trubee Davison	A. Raymond Dochez
John Elliott	Peter Gimbel
Robert I. Gannon	Robert G. Goelet
Peter Grimm	De Forest Grant
Fairfield Osborn	Eugene Holman
Eben Pyne	Warren Kinney
Laurance S. Rockefeller	William De Forest Manice
John M. Schiff	Harold J. O'Connell
Henry Sears	Landon K. Thorne
Edwin S. Webster, Jr.	J. Watson Webb

Ex-Officio, The City of New York
The Mayor, Hon. Robert F. Wagner
Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *General Director*

ZOOLOGICAL PARK

Leonard J. Goss *Assistant Director
& Veterinarian*

William G. Conway *Associate Curator, Birds*
Grace Davall *Assistant Curator, Mammals & Birds*
James A. Oliver *Curator, Reptiles*
Charles P. Gandall *Associate Veterinarian*
Gordon Cuyler *Administrative Assistant*
Herbert J. Knobloch *Assistant Curator, Education*
Charles B. Driscoll *Superintendent,
Construction and Maintenance*

Edward Kearney *Manager, Facilities Dept.*

Lee S. Crandall *General Curator Emeritus*
William Beebe *Honorary Curator, Birds*

AQUARIUM

Christopher W. Coates *Director*
James W. Atz *Assistant Curator*
Ross F. Nigrelli *Pathologist*
Myron Gordon *Geneticist*
C. M. Breder, Jr. *Research Associate in Ichthyology*
Harry A. Charipper *Research Associate in Histology*
Homer W. Smith *Research Associate in Physiology*

GENERAL

Herbert F. Schiemann *Comptroller*
William Bridges *Editor & Curator, Publications*
Dorothy Reville *Editorial Assistant*
Sam Dunton *Photographer*
Henry M. Lester *Photographic Consultant*

DEPARTMENT OF TROPICAL RESEARCH

William Beebe *Director Emeritus*
Jocelyn Crane *Assistant Director*
Henry Fleming *Entomologist*

Associates
William K. Gregory John Tee-Van

SCIENTIFIC ADVISORY COUNCIL

A. Raymond Dochez Caryl P. Haskins
Alfred E. Emerson K. S. Lashley
W. A. Hagan John S. Nicholas

AFFILIATES

C. R. Carpenter, *Co-ordinator*
Animal Behavior Research Programs
L. Floyd Clarke, *Director*
Jackson Hole Biological Research Station

CONSERVATION FOUNDATION

Stephen W. Bergen Hugh J. Ross
George E. Brewer, Jr. Robert G. Snider
John C. Gibbs Peter M. Stern
Samuel H. Ordway, Jr.

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

In This Issue

The New Walruses	Cover
Muyoni, Our New Female Okapi	
Ralph Graham	162
A Field Study of African Parks and Wildlife	
Fairfield Osborn	170
We Are Moving into the Aquarium	
William Bridges	173
Zoo News in Pictures	
Sam Dunton	175
The Oddest-looking Crocodilian	
James A. Oliver	178
The American Beaver (Part 3)	
Albert R. Shadle	181
News from the Conservation Foundation	186
Behind the Scenes	187
Index	189

Vol. LIX **NOVEMBER** **No. 6**
1 9 5 6

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

The Rightness of Animals

*"I think I could turn and live with animals,
They are so placid and self-contain'd,
I stand and look at them long and long.
They do not sweat and whine about their
condition,
They do not lie awake in the dark and weep
for their sins,*

.

*Not one is dissatisfied, not one is demented
with the mania of owning things,*

.

*Not one is respectable or unhappy over the
whole earth."*

WALT WHITMAN, *Song of Myself*

Recently, during the heat of the crisis about the Suez Canal, I happened to be talking with an official of one of our large corporations that had interests in the Near East. I remarked, "I guess you've got your own problems." He retorted, "We certainly have," and went on to speak of the damage that had occurred to some of their properties and the threat of further difficulties. Then he added, "About the most cheering thing I've seen in the newspapers these last few days was the photograph of that Okapi that has just come to the Bronx Zoo as a gift from the Belgian Congo government. That gave me a real lift, and I remember thinking to myself, 'Well, I guess the world's still all right.'"

So was Walt Whitman.

Fairfield Osborn

A MAGNIFICENT GIFT—
Muyoni, Our New Female



Okapi

By RALPH GRAHAM

Assistant Director, Chicago Zoological Park

SINCE THIS ARTICLE WAS WRITTEN, *Muyoni* has been received at the Zoological Park. All Okapis carry a certain number of intestinal parasites in the wild. *Muyoni* was unusually heavily infested when she arrived. Despite sanitary measures taken in the Belgian Congo and medication since she reached the United States, these parasites have persisted. Our experience with previous Okapis — one of which lived 15 years — indicates that they do well if they arrive in good condition. *Muyoni*, unfortunately, arrived in very poor condition.

EARLY THIS SUMMER M. Leon Petillon, Governor-General of the Belgian Congo, advised several European and American zoos that his government was presenting them with that interesting, beautiful and seldom-seen animal, the Okapi. Both the New York Zoological Park and the Chicago Zoological Park were included. Each has a male Okapi (the only ones in the United States up to now), and it was specified that each was to receive a female, in hope that breeding would result.

A more greatly appreciated gift cannot be imagined and the gesture was as magnanimous as the gift, not only in its implications of international good will and friendship but also in its recognition of the part that zoological parks play in the conservation of the animal life of the world. I am sure all the zoos concerned will concur.

Since I had been in the Congo in 1955 on be-

Muyoni at liberty in the big enclosure of the Okapi Station at Epulu. One of the feeding racks, draped with leaves which the animals like to eat, is visible at the left. The soil is sandy and easily cleaned.

(All photographs by the author)

half of the Chicago Zoological Society to chaperone an Okapi from Stanleyville to Hamburg and since I had been able to find my way home unattended, that organization felt it could push its luck once more by sending me again. The New York Zoological Society, upon learning that I was going, asked me to bring its Okapi and offered to share expenses. I am extremely grateful to the New York Zoo for having that much confidence in me and I can only say that I hope both our Okapis will have long, happy and fruitful lives.

I was fortunate in seeing the whole process of Okapi capture, care, treatment and local transport. I cannot overemphasize my admiration for the intelligent and humane way in which every part of the process is handled. The credit for this belongs to the Game Department and Captain Jean de Medina who has charge of the Okapi Station at Epulu in the Ituri forest. Thanks to his careful observations of the Okapi and its habits, and his institution of intelligent, sympathetic methods for the handling, comfort and health of the animals, the Epulu station has become highly successful.

After seeing the vastness and the incredible impenetrability of the Ituri forest, the home of the Okapi, I found it easier to understand why the animal remained undiscovered until the early part of this century. It is so wonderfully adapted to its environment by its shy, quiet habits and its beautiful protective coloration and pattern that it can be thought of as part of the forest. More wonder, then, that Captain de Medina has learned so much of the Okapi and its character and has been able to capture so many and keep them successfully.



Signs such as this are set up beside the road when an Okapi falls into a pit, to call it to the attention of the game department.

An Okapi has fallen into this pit and it has been covered by heavy branches and leaves to keep the animal from struggling to escape.



As far as I know, the boundaries of the Okapi's range within the Ituri forest have not been definitely established, but it seems reasonable to assume that the animal roams the major portion, as individuals have been captured in various districts separated by some distance east to west. It appears now that in numbers it is not as sparse as once believed. As a matter of fact, between Stanleyville and Epulu I saw three Okapis in varying stages of capture within a few miles of each other and in each case the capture-pit was within 200 feet of the road.

It is fortunate that Okapis can be taken so close to the road, as that means much less work in getting them on a truck. Captain de Medina's men search out a suitably located trail or path used by an Okapi and there they dig a pit approximately six feet long, three feet wide and a little more than six feet deep. The floor of the pit is built up with a thick layer of leaves so that the Okapi will not suffer injury in its fall. The top of the pit is covered loosely with light branches and over the branches leaves are scattered so that the covering blends with the adjacent ground. I was shown such a pit, but as far as I could tell it

looked like the rest of the surroundings — undisturbed forest floor. Apparently Okapis have eyes no sharper than mine, for sooner or later one walks down the path and drops into the pit.

After the Okapi is in the pit, a group of men, including the local Pygmies, build a round stockade of approximately twenty feet in diameter with an opening at the pit. The stockade is built of long poles cut from branches, sharpened at one end and jammed into the ground. These are set three or four inches apart and secured with jungle vines.

Dirt is shovelled into the front end of the pit until a ramp is formed, and up this the Okapi climbs into the stockade. This is considered the most critical part of the capture, for when the animal finds itself free of the pit it often tries to dash through the stockade fence. Captain de Medina has found that by placing men all around the outside of the fence at approximately arms' length apart, the Okapi sees them through the interspaces of the poles, which causes it to stop short of the fence in each rush. In a short time it becomes quiet.

When they start to build the stockade, the men

establish their camp adjacent to it. This serves a twofold purpose — first, because of the proximity of the men and their movements, their incessant chattering and their odors, the Okapi soon becomes accustomed to them. This acclimatization period is very important and much more sensible than moving the animal immediately. The second purpose of the camp is to provide insurance against Leopards preying upon the Okapi.

When it is decided to move the Okapi from the stockade to the station at Epulu, after a minimum period of one week, a way is cleared through the forest from the stockade to the road.

A stockade runway has been built from the capture pit to the road and through this narrow opening the Okapi will walk into a truck.

One wall of the stockade runway. This starts at the capture pit and may run several hundred feet through the forest to the road.



Along this clearing a runway just wide enough to accommodate the Okapi is constructed in the same manner as the stockade, except that the poles are placed closer together. At the road a ramp of dirt about forty inches high is built, with the runway following its contour and ending abruptly at the road. A truck carrying a crate completely enveloped in leaves is backed up to this and the open end of the crate blocks the ramp terminus of the runway.

When the Okapi is released from the stockade into the runway it can proceed only in the direction of the ramp. Here a barrier of poles thrust across the runway stops its progress. After a few moments' pause the poles are removed, and the animal plunges up the ramp and into the crate, whereupon the end gate is fastened and the Okapi is ready to be trucked back to the Epulu station. The reason for stopping the animal at the beginning of the ramp is to check its speed so that it will not rush into the crate and injure itself.

At the Epulu station it is released into a stockade amply large enough to permit exercise. It is kept here for a short time and then shifted



to a larger enclosure where it can enjoy the company of other Okapis.

Epulu lies west of the Epulu River in the Ituri forest, about three hundred miles east of Stanleyville and a few miles north of the Equator. Here is Captain de Medina's headquarters and home, as well as a few outbuildings and the Okapi enclosures. Across the road is the Hotel Domaine des Okapis, much like our motels. A more beautiful setting would be hard to imagine, with colorful flowers, shrubs, green grass and red paths forming a pattern against the river and the immense forest. The river is very swift here, cascading in a series of rapids directly opposite the Okapi headquarters.

Pygmies, while nomadic, seem to be plentiful hereabouts. Captain de Medina uses some of the

men in the Game Department for his Okapi work.

The Okapi station is maintained by and is under the direction of the Game or Conservation Department of the Belgian Congo. Besides Okapis, a few other animals are kept for visitors to see, including a cigarette-smoking chimpanzee, a lion, baboons, a few monkeys and thirteen elephants. The latter are brought down to the river late every afternoon for their baths. I made it a point to be on hand when the elephants came plodding out of the forest to the river. To see so many of these huge animals playing in the water, enjoying every minute of it, their dark skins and white tusks gleaming in the afternoon sun, formed a grand picture which I shall always remember.

As soon as a newly-captured Okapi is brought

to Epulu it is assigned a number and given a name and this, together with other information such as sex, markings, estimated age and date of capture, is sent to the office of the Game Department at Leopoldville. When an Okapi is to be shipped out, the office sends a directive to Captain de Medina to the effect that number so-and-so Okapi is to be crated for such-and-such zoo and is to be ready for shipment on a certain date. Some of the Okapis are named after the districts in which they were taken, such as Nepoko, Epini, Aribi and Adusa, while others have simple native names. Ours are named thus. New York's Okapi is called "Muyoni," which means "Heart," and the one for the Brookfield Zoo is "Museka," or "Maiden." The largest Okapi in the collection when I was there was named "Claire" and was assigned to the Copenhagen Zoo. Muyoni was the latest acquisition at Epulu. She was taken on June 10, 1956, and was number 73. Chicago's Museka was captured on March 14, 1955, and her number is 58.

There were twenty-five Okapis at Epulu, not counting the recently captured three seen on the way from Stanleyville. The sexes were about evenly divided and in most of the enclosures — of which there are about ten — males and females are together with varying numbers in each enclosure. There are no babies now, but there have been a number of births.

The underbrush and small trees have been

cleared out of the enclosures, leaving the large trees to furnish shelter and shade. In some yards there were so many trees that not enough light filtered through to allow photography. I noticed that even on a dark, overcast day the Okapis preferred to seek the seclusion of the trees rather than to stay in the open. The cleared underbrush, while differing from the Okapi's forest habitat, serves the purpose of allowing the ground to be kept clean.

Captain de Medina observed that the Okapis often lay in a spot where there might be some droppings, and he reasoned that since the animal is always licking itself, it would probably re-infest itself if it happened to be infested by parasites. Clearing the underbrush was the first remedial step. The next was to assign one or two men to each yard to scoop up droppings as fast as they appear, carry them to one spot where a fire is smouldering and burn them immediately. The soil is very sandy and with frequent rains washing it, the yards always appear immaculate.

According to Captain de Medina, the Okapi eats 19 different varieties of leaves. All of these can be found near Epulu. Each day several men go into the forest and cut that day's supply. It is brought to the road and piled in a huge wagon equipped with automobile wheels and tires. The wagon is pulled to the station by two huge, perfectly matched elephants. Even their long tusks are the same length and have the same curve.

The Okapi Station at Epulu lies alongside the Epulu River. Headquarters of Capt. de Medina are in the large building, and Okapi enclosures for animals awaiting shipment are directly behind.

Thirteen well-trained elephants are kept at the Epulu station and every afternoon they are allowed to stroll down to the river for a bath — which they enjoy with a great deal of splashing and play.





Rough racks about twenty-five feet long and high enough to allow an Okapi to walk under them are fixed in each of the enclosures. The fresh branches and leaves are tied to these racks each day, after every vestige of the previous day's food is pulled down and burned in the fire with the droppings. Watering troughs are about a yard square and the same dimension in height. They are constructed of concrete, faced on the outside with brick. The top or basin holds about three inches of water and is curved gently to the edge, which makes for easy cleaning. Beside each water trough is a small table of equal height on which is an ample supply of coarse salt.

All of the Okapis at Epulu appeared to be in excellent health and their coats, varying from reddish-brown to black, had a sheen that one associates with healthy animals. Almost all of them had some superficial imperfection such as scars or ragged ears.

The Basel Zoo had sent its Assistant Director, Walter Wendnagel, to take delivery of its Okapi and we managed to meet at Stanleyville on the way in. We had met in Basel in 1955, so it was like old home week in Stanleyville when we got together. He is an excellent companion and he speaks fluent French, which was a great aid at times. A few years ago he and Captain de Medina had accompanied some Okapis down the Congo River from Stanleyville to Leopoldville, on to Matadi by train, and thence to Europe by boat. The journey took some weeks, and we agreed that we were thankful we did not have to repeat that trip.

In order to reach the Okapi station from Stanleyville, stopping overnight at Bafwasende, we hired an automobile from the man who trucks Okapis back to Stanleyville. His car, like the Congo, was timeless but it did nevertheless carry us to Epulu. The driver knew Charles Cordier

and he pointed out the village of Bongena where Cordier made his headquarters in 1948 when he was collecting for the New York Zoological Society.

The carpenter shop at Epulu builds the shipping crates for the Okapis. Walter and I lined the inside of our crates with folded cloth stuffed with dry leaves. This was to keep the animals from being scratched in the crates. Actual crating took only about five minutes. The Okapis were driven into a funnel-shaped runway, up a ramp and into the crates in the same manner as they were crated from the capture-stockade.

Our little caravan of three Okapis, three white men, seven natives, one truck and one passenger car left Epulu at 2:00 p.m. on Tuesday, July 17. We intended to drive steadily through the night, hoping to reach Stanleyville some three hundred miles distant not later than 8:00 a.m. on Wednesday, for our plane left at 5 o'clock that afternoon and the intervening time would be needed to complete final details — weighing the Okapis, getting export licenses and veterinary certificates, signing a host of papers and clearing customs.

Muyoni, the Okapi at the right, in the enclosure at Epulu. The scars on her flanks and sides are a result of minor injuries received when she fell into a pit on June 10. The injuries have now healed.

Fate had different plans for us. First, the battery in the passenger car went dead, and so did the generator. After an hour's wait, a truck came along. Luckily it carried an extra battery, which the Indian driver was kind enough to lend us. Some miles later the car stopped again, this time with an ominous and generalized rattle. We tried everything anyone could think of, but it was no use; after four hours of tinkering we simply pushed the car to the side of the road and everybody piled on the truck with the Okapis and we bounced onward. At dawn it started to rain as it can rain only in the tropics, and the downpour continued for three hours. The Okapis did not seem to mind it.

The Sabena Airlines people at Stanleyville were worried about our failure to appear on schedule but they suspected what the reason was and sent a reliable automobile to meet us a few miles out of town. We met at 2:00 p.m. I jumped in

it and practically flew into town where I got all our papers in order and signed. Walter stayed with the truck and looked after the weighing of the Okapis.

The plane trip from Stanleyville to Brussels was uneventful. Walter Wendnagel and I were too tired to sleep more than in brief naps, waking constantly to go forward to see about the Okapis. *They* were not worried. Muyoni and Museka lay down in their crates and slept most of the way. They must have been exhausted from bouncing so long in the truck.

Upon arrival in Brussels early Thursday morning, Sabena had two DC-3 planes waiting on the apron for Walter and me. After a scurry of unloading and re-loading, posing for press photographers and television men, I bade Walter a hurried good-bye and Muyoni, Museka and I were off to Hamburg, which we reached in two and a half hours. The Okapis were in the quarantine station in Hamburg just 21 hours after leaving Stanleyville. Walter flew with his Okapi directly to Basel, as Switzerland does not require a quarantine period for ruminants entering the country.

I stayed with the Okapis in Hamburg for a week. This period I considered critical, for it was the period of converting them from their normal diet of leaves to foods which are a substitute and which we can supply. The quarantine attendant and I found they liked willow and oak leaves. The next food they accepted was oatmeal offered first in their water. Then we found a grass they seemed to enjoy. To this we added lucerne, similar to alfalfa, gradually reducing the amount of grass until they were eating just lucerne. When I left Hamburg they were eating with some enjoyment bread, carrots, greens, oranges, lemons, onions, bananas and apples.

On the way home I stopped for one day to visit Walter Van den bergh, Director of the Antwerp Zoo, and to see his two pairs of Okapis. They are beautiful animals. As usual he was a most delightful host and was pleased that the Belgian Congo had presented the Okapis and that we had been successful in bringing them to Europe.

In conclusion I would like to offer the hope that Muyoni and Museka, with the aid of Bilota in the Bronx and Aribi at Brookfield, will become the matriarchs of a sturdy and large herd of "American" Okapis.

A Field Study of African Parks and Wildlife

By FAIRFIELD OSBORN

A FIELD STUDY of the national parks and wildlife reserves of Africa and the present status of wildlife on that continent has been undertaken by the Zoological Society and the Conservation Foundation. Its first tangible result will be the publication of a Handbook of African National Parks and Wildlife Reserves; we can only guess how far-reaching may be the consequences of this fresh and comprehensive study.

The study will be made by George W. Treichel, a graduate of the University of California, who has been trained in geography, ecology and conservation, and his wife Jeanne, an experienced teacher of natural science. To both of them this undertaking represents the culmination of years of advance study and preparation. They began their field work in Kenya in November and during 1957 will visit a maximum number of wildlife areas in East Africa and the Belgian Congo, Mozambique, the Central African Federation and areas to the south.

At the present time a comprehensive naturalist's guide to the parks, wildlife reserves and natural areas of Central and South Africa is not available. Much information does exist in widely scattered but not readily obtainable source material. However, for two major groups there is a definite need for a volume giving comparative treatment of the various park and wildlife reserve areas: conservationists far removed from the scene but concerned with the problems which threaten the continued existence of some refuge areas; and the increasing number of individuals who plan to visit or study on the continent. In many areas, the viewing of wildlife and wild scenery has become the dominant attraction, especially

since unspoiled tribal life is rapidly diminishing.

The primary objective of this field project, therefore, will be to collect sufficient additional information for the production of a handbook. Intensive library preparations have been completed. The ultimate success of the project will depend largely upon the assistance offered by park and wildlife personnel who have had firsthand experience in the various areas. Information concerning conservation laws, practices, and issues for each political unit will be summarized in the text after which the following classes of areas will be covered.

- (1) *National parks.* These are, for the most part, the better known areas, but there is considerable variation in the types of areas called "parks," for statute provisions differ widely.
- (2) *Complete and partial wildlife reserves.* These serve as extremely important game reservoirs and many equal or even surpass the national parks in size and importance. However, in some cases, the wildlife is preserved only until the land can be put to more economic use, or until land users at the periphery are inconvenienced by depredations.
- (3) *Bird concentration areas.* The large water bird concentrations are of particular interest. In the past the multitudes of large mammals have diverted attention from Africa's rich and striking avifauna.
- (4) *Wetlands.* The large swamps and marshes are important wildlife reservoirs and, like wetlands everywhere, they face an uncertain future.
- (5) *Mountain wilderness areas.*
- (6) *Other superior natural areas* — lakes, rivers, waterfalls, and routes.

Detailed information about the specific areas will be arranged under topics of practical inter-

The great plains of Tanganyika dominated by Mount Kilimanjaro are the home of great aggregations of wildlife. Here Mr. Treichel will make part of his survey of parks and reserves and animal resources.

Photograph by Ylla, from "Animals in Africa"





The Albert National Park in the Belgian Congo is a model of park management and wildlife protection. Hippopotamuses abound in and around the Rutshuru River, which flows through the park.

est: Location and size; accessibility, approaches and interior routes; terrain features and vegetation cover types; principal natural attractions, fauna highlights and concentration points; facilities for visitors, if any; representative list of natural history literature dealing with the area; origin, history and administration, in condensed form; problems and threats to the future security of the areas — this latter a most significant feature of the study.

Mr. and Mrs. Treichel also expect to introduce some aspects of several subjects that are basic to an understanding of wildlife conservation — distribution and movements of the large herbivores; game-empty areas; major habitat divisions; recurring droughts and locust eruptions; economic importance of wildlife; the African poacher as the “greatest destroyer”; diseases and infestations; wholesale destruction schemes; and threatened species.

Both the Zoological Society and the Conservation Foundation feels that the handbook — and

the magazine articles and lectures that presumably will follow — will be of great value in increasing the interest in the unrivalled animal resources of Africa, in providing a readily available source of basic information for anyone planning a visit to the areas, and create a greater awareness of the problems of maintaining the wildlife areas now existing.

We hope, too, that it will indicate the importance of preserving additional examples of the representative and unique areas wherever possible, for sometimes the highest practical long-term value of much land may be as a wildlife habitat.

Finally, we hope that it will arouse public interest and support for international conservation organizations and their programs which focus on resources having international as well as national values. The conservation movement must convince administrators in all African areas of the value of maintaining at least a portion of their rich natural heritage.

WE ARE MOVING INTO THE AQUARIUM

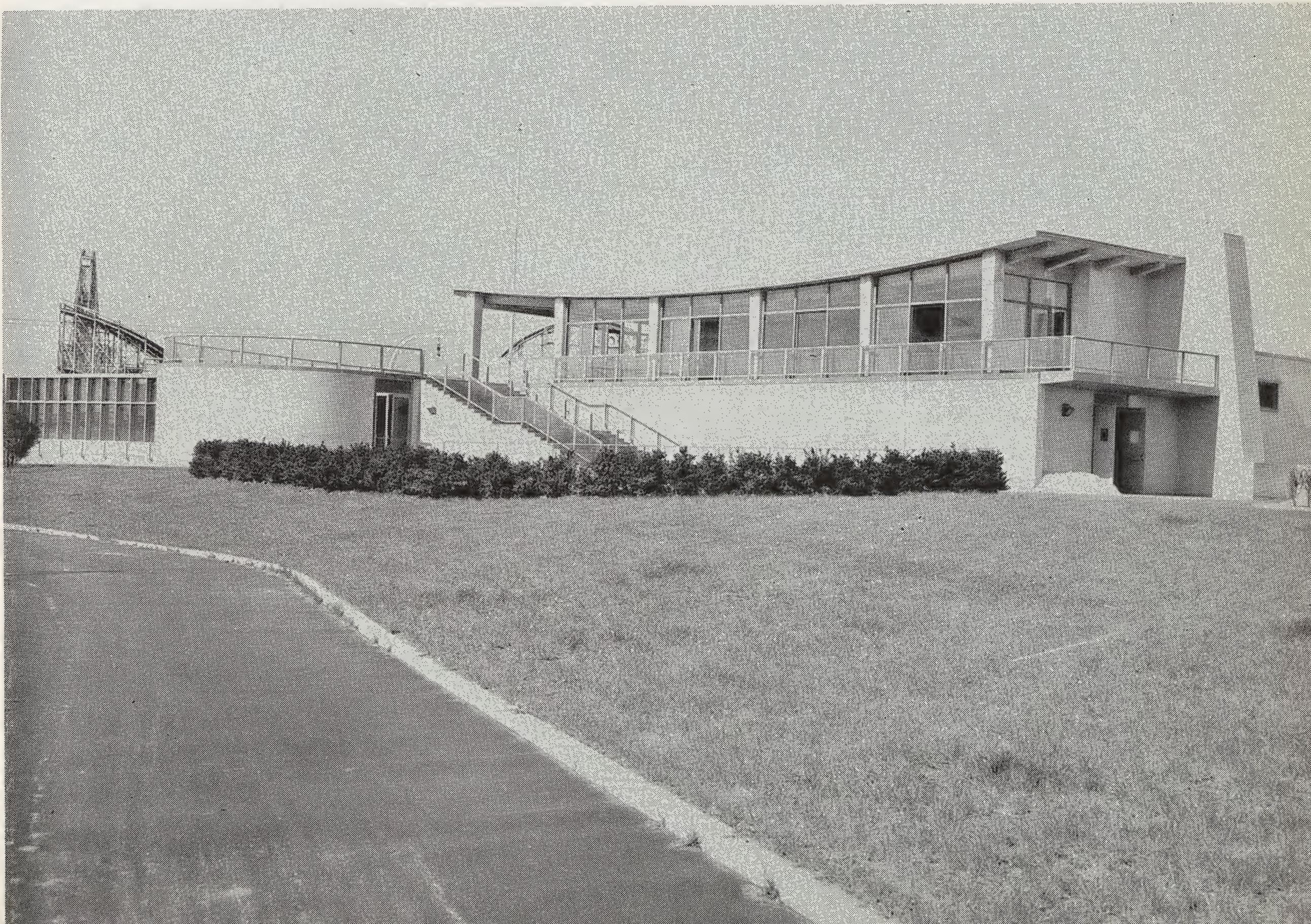
By WILLIAM BRIDGES

The Aquarium seen from the Boardwalk at Coney Island — a clean, fresh, sparkling addition to the attractions of the seaside playground. The wide steps lead to the restaurant.

THE FIRST UNIT of the Aquarium, located on the oceanside at the eastern end of Coney Island, was officially turned over to the Zoological Society on September 27. The strenuous task of equipping the structure for its function of exhibiting marine life is now proceeding swiftly and we are aiming at an opening to the public (with, of course, a preview for Members of the Zoological Society) in mid-May of next year.

The first specimens for exhibition have already arrived: two of the most personable young Atlantic Walruses anyone could want to see. The fishes, as well as more marine mammals and birds, will not begin to arrive until the coming of warm weather in early spring. By that time tanks of conditioned water will be ready to receive them — and when they start coming from tropical and sub-tropical seas, they will arrive quickly and in large numbers.

Director Christopher W. Coates has now moved his office from the Zoological Park to the Aquarium and is directing the testing of pumps and circulating systems, the assembling of collecting gear, nets, shipping containers for fish, the pumps and filters to be installed in the Aquarium's truck, and all the other thousand-and-one details of the





The two large tanks at the left in the main hall of the Aquarium will be devoted to bright fishes from coral reefs of the tropics.

Visitors entering the Aquarium will pass down this hall beside windows looking underwater into an oceanic tank of large fishes.

outfitting of a new institution. Other members of the Aquarium's staff are remaining at the Zoological Park for a few weeks more to maintain the collection of freshwater fishes that has been exhibited in the Lion House for the past fifteen years. Eventually most of these fishes, except a few of special scientific interest, will be distributed among other public aquariums in the United States, for the Aquarium will (in its first stage) be set up to exhibit mainly marine life.

Before the arrival of tropical fishes in the spring, local "stand-ins" will be used to condition the sea water in the tanks and to give the staff of new tankmen a certain amount of practice in maintaining an aquarium. Collecting of these local fishes will begin well before the end of the year.



One of the major jobs that was begun as soon as the building was turned over to the Aquarium staff is the creation of a decorative habitat for coral reef fishes in two tanks, one eighteen feet long and the other sixteen and a half feet in length. Miss Clara Hankins, a sculptor, has been engaged to design and build the large, yet movable, sections of reef that will be the home of hundreds of brilliant tropical fishes.

It has taken many years to reach the present point in our progress toward a great Aquarium for New York City, and additional millions of dollars will be required to complete further stages. But we are on our way now, and so far — very good!

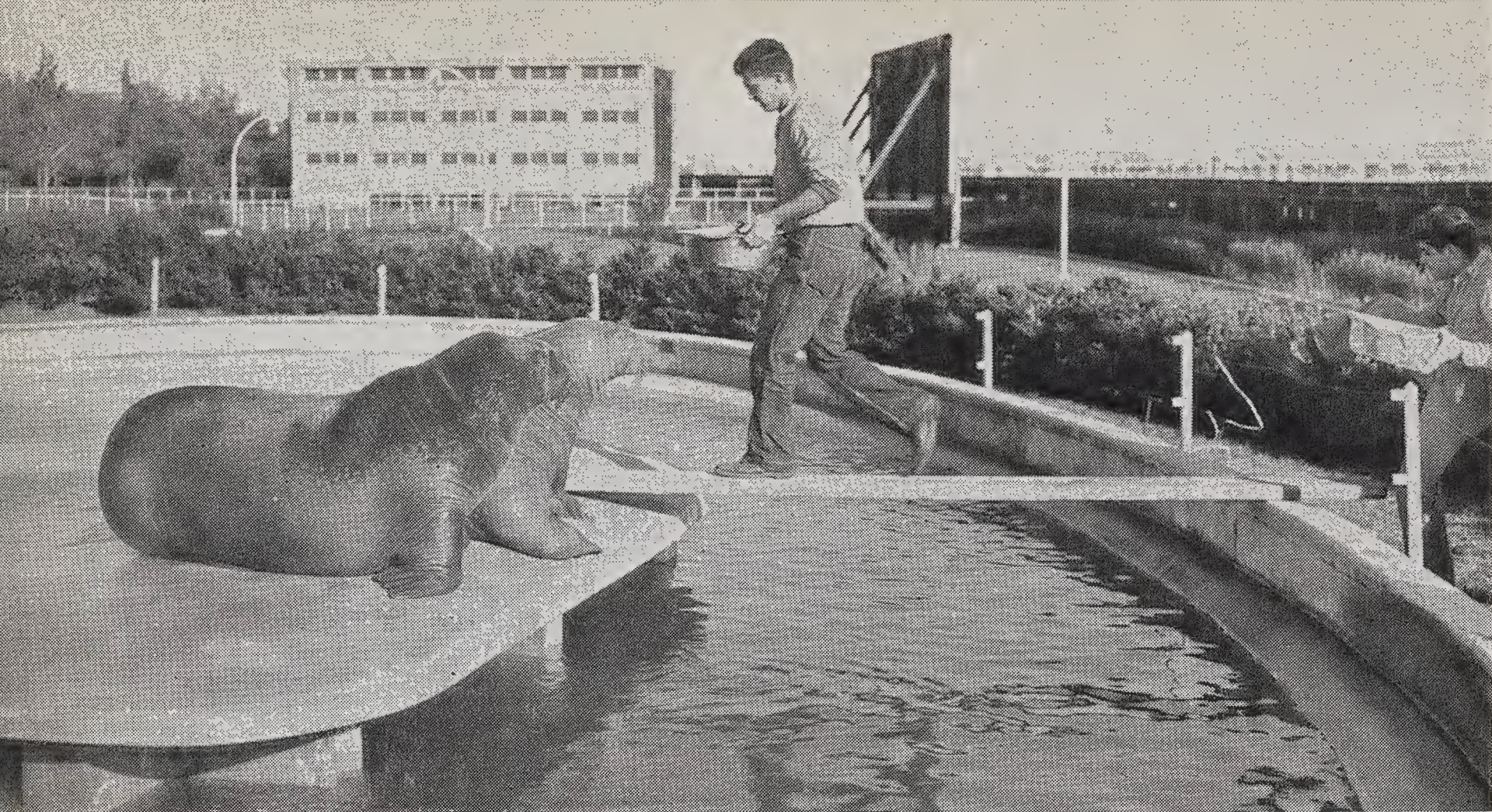
ZOO NEWS IN PICTURES

Photographs by SAM DUNTON

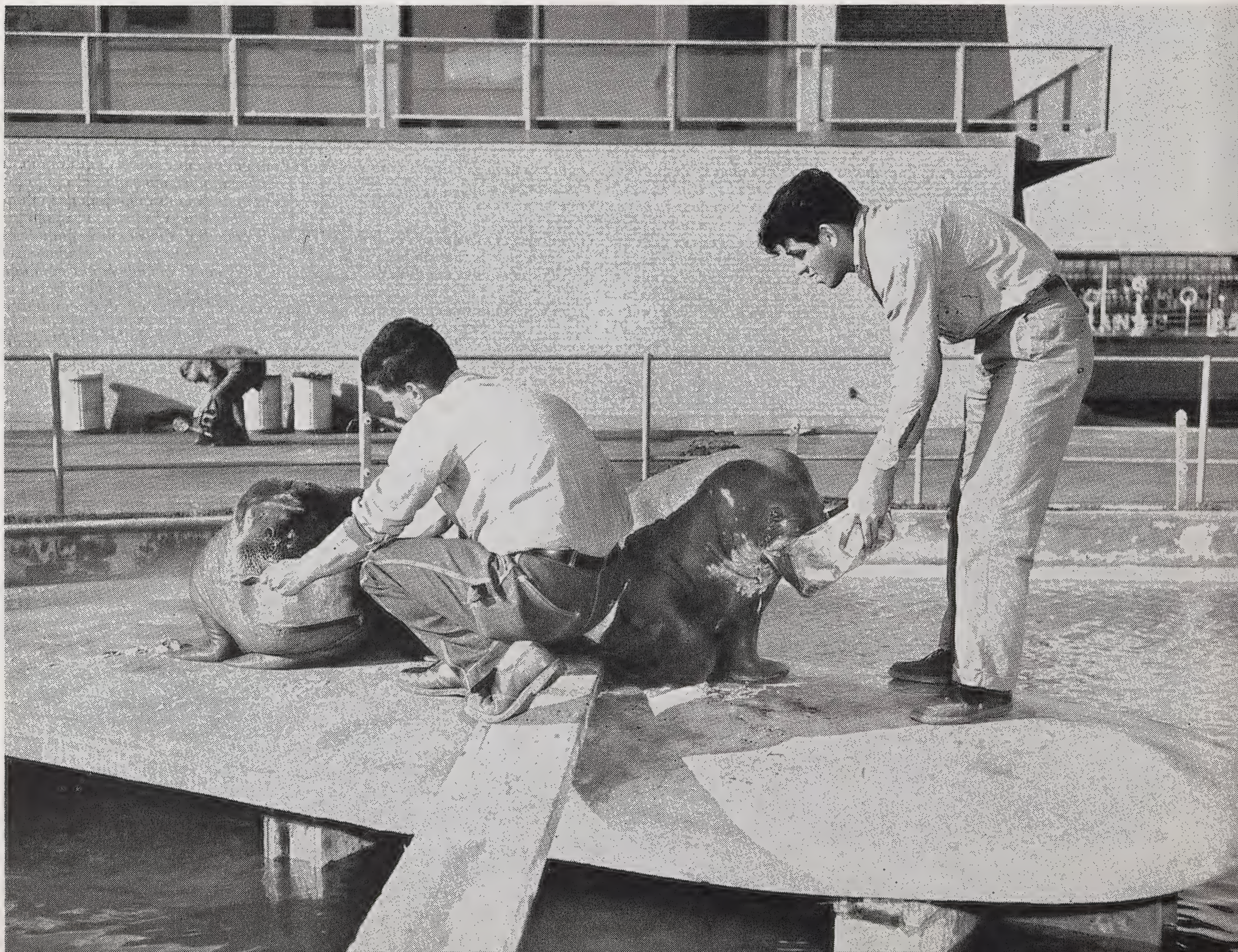
Climbing is the favorite occupation of our **MARKHORS** and to give them something worthy of their sure-footedness an aerial perch has been built in the corral at the top of Goat Hill. The animals spend much time on the plank. And they are growing, too; the male now has a beginning of a fine beard.

All is quiet in the **HIPPOPOTAMUS** paradise these days. When Phoebe II came to us on August 30, to replace the previous Phoebe who had died in July, her attitude toward the young male, Peter II, was distinctly cool at first. Now they have become more settled and are the best of friends.





Provisionally, at least, they have been named **OLAF** and **KAREN** — good Danish names, as befits young **WALRUSES** presumably taken by Danish seamen in the Arctic. These are the first specimens acquired by the new Aquarium at Coney Island, and although the Aquarium itself will not be open until next spring, the Walruses are temporarily quartered in a pool alongside the Boardwalk and are attracting interest that speaks well for the appeal of the whole Aquarium. Some of these days more commodious (and convenient) living quarters will be ready for them, but in the meantime they have been getting plenty of fun and excitement out of their present pool. Aquarium keepers have to cross a narrow gangplank to carry fish to Olaf and Karen several times a day, and they have to be even more agile once they reach the concrete island, for Olaf has had a ravenous appetite and in his eagerness to get at the cut-up fish has twice knocked the feeding pan into the water — and once the keeper with it. Nor have barriers, either electric fences or solid planks, stopped him and Karen when they took it into their heads to go wandering around the fenced-in Aquarium grounds. Fortunately they are as good-natured and harmless as they are strong and willful, and at the approach of a keeper, when surprised in one of their forays out of the pool, they turn around and flop back, usually to settle down and sleep.







THE ODDEST-LOOKING CROCODILIAN

By JAMES A. OLIVER

the end of the Cretaceous geological period, about 70 million years ago, "the three groups of modern crocodilians had appeared, namely the pointed-snouted crocodiles, the broad-snouted alligators,

Four young Indian Gavials have been presented to us and now we have the agreeable job of fattening them up, for they arrived in poor condition.

With only one jaw (as the result of an accident), a Gavial would seem to be badly handicapped in eating. But not so our one-jawed specimen

THE INDIAN GAVIAL (*Gavialis gangeticus* Gmelin) is undoubtedly the oddest looking of all living crocodilians. In fact, its external appearance is more reminiscent of the fossil Phytosaurs than of the other species living today. However, this external resemblance is only superficial and the Gavial is merely a specialized crocodile and not a survivor of the narrow-snouted Phytosaur clan that died out 155 million years ago.

While the Gavial is not a close relative of the ancient Phytosaurs, its lineage goes far back in the fossil record. If we look into the fossil history of the crocodilians, we find that the ancestral forms lived 180 million years ago at the beginning of the Age of Reptiles. About 150 million years ago these ancestral crocodiles gave rise to the modern types. According to Dr. Edwin H. Colbert, who outlined their history in his interesting book, "The Dinosaur Book," the first modern crocodilians were small but in turn gave rise to a successful group of large, active species very similar to the forms living today. He said that by

and the very narrow-snouted gavials. Indeed, the [true crocodile] pattern was well set in the Cretaceous, for there has been very little significant change in the crocodilians since that date."

While there has been little change in the structural features of the crocodilians, there have been notable changes in size and geographic distribution. Many of the fossil crocodilians were truly gigantic in their proportions and we can be thankful that predatory crocodiles 50 and 60 feet long are a thing of the past. The largest of our modern crocodilians appear to have a maximum length of 25 to 30 feet—and these lengths are rarely attained.

Within the past 60 million years the crocodilians, including the Gavials, occurred over a larger portion of the world than they do today. For example, Alligators lived as far north as Canada. Gavials, which are now found only in India,

occurred over a wider area in Asia, including the East Indies, and in Africa. Slender-snouted, gavial-like crocodiles occurred in Europe and North America as recently as 20 million years ago. Walter Auffenberg recently discovered the fossil remains of a number of these crocodilians in northern Florida. One nearly complete skeleton, now mounted in the Florida State Museum in Gainesville, was estimated to have been about 23 feet in length.

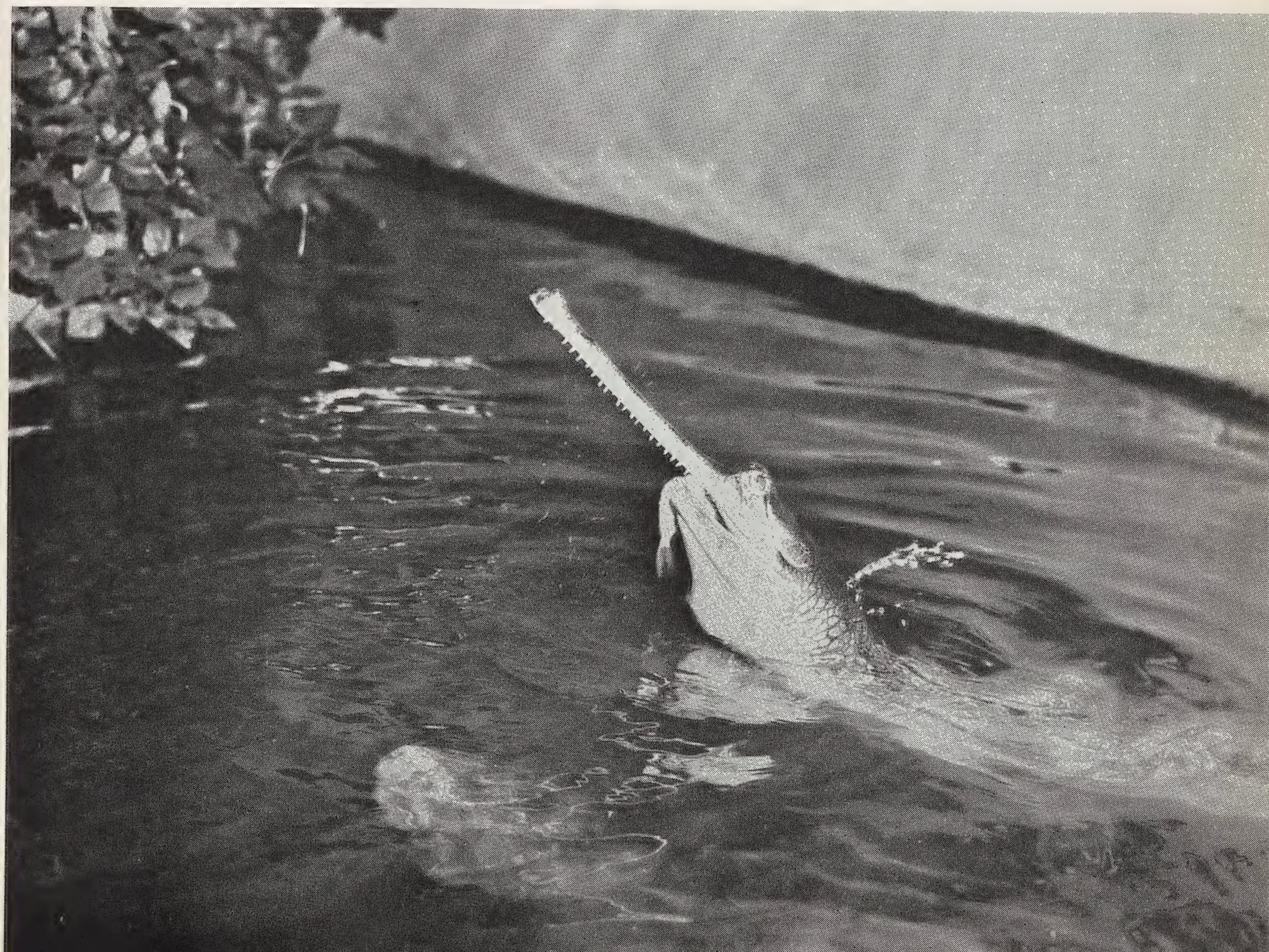
True Gavials occur today only in the rivers of northern India, from the Indus on the west to the Brahmaputra on the east. There is one doubtful record from the Irrawaddy River in Burma. The Gavial is found only in rivers but inhabits the quiet back-water areas. It has seldom been seen in lakes or estuaries.

The Gavial is primarily a fish-eater and the long slender snout is believed to be an adaptation for catching fish. The mouth is lined with sharp, needle-like teeth — 27 to 29 on each side of the upper jaws and 25 or 26 on each side of the lower jaws, making a minimum of more than 100 teeth! When a fish is caught in this trap it never gets away. The Gavial, like the other crocodilians,

catches fish by sudden, quick sideward jerks of its head. Its narrow, rounded snout reduces the resistance of the water, enabling the jaws to move and snap quickly. Sometimes more than one fish is caught at a time in the long jaws. It is interesting to see the skill with which a Gavial maneuvers a fish the length of its long jaws without dropping it, turning it so that it is swallowed head- or tail-first. This is done without a hitch and almost so smoothly that the fish seems drawn into the mouth.

For some time it was thought that Gavials ate only fish, but the remains of birds, dogs and goats, as well as human ornaments, have been found in their stomachs. Natives of the regions in which Gavials live do not seem to fear them and it is believed that they rarely attack human beings. The finding of ornaments in the Gavial's stomachs is believed to result from the eating of corpses rather than from attacking living human beings.

Little is known about the habits of the Gavial in the wild. According to Mr. Humayun Abdulali of the Bombay Natural History Society, the Gavial differs from all other living crocodil-



ians in being primarily diurnal in its activities. This may explain why its eyes shine only faintly in the presence of a light. The eyes of all other crocodilians, to our knowledge, shine brightly under such circumstances. Many nocturnal animals possess a reflective material, crystalline guanine, either in the retina or on the inner side at the back of the eyeball. This material causes the eyes to shine at night in the presence of light and results in greater visual sensitivity in dim light.

Like all crocodilians, the Gavial reproduces by laying eggs. These are said to be deposited in holes in sandbanks. The eggs have been reported to number 40 or more. In 1913 Baini Parshad shot a female Gavial that measured 9 feet 7 inches and that contained 56 eggs. The eggs were fully developed, covered with a hard shell and were apparently about to be laid. One measured 3.6 x 2.8 inches.

Female Gavials are smaller than males, seldom exceeding 14 feet in length. The largest male on record measured 21 feet 6 inches. A number of books attribute a length of 30 feet to this species, but such outsized lengths are not based on authentic records. In old males the tip of the snout is enlarged and rounded. According to one story, this was the basis for the animal's name since the rounded protuberance resembled an earthen pot or "ghara." Thus the original name was Gharial and is sometimes spelled Garial. When Dr. Gray proposed a new genus for this animal in 1831 he meant to name it *Garialis*, but the printer put in a "v," instead of an "r." The name has become established now as *Gavialis*, with the common name, Gavial. Needless to say, it is still called Gharial in India.

Gavials are prized zoological exhibits, but are hard to get and therefore somewhat rare in zoological parks. We exhibited our first Gavial in 1911, but we do not have a record of how long this specimen lived. One individual in the London Zoo lived there 24 years. In 1946 we purchased a female Gavial from a dealer. Until last year this was the only Gavial known to be on exhibition in the United States. When we moved our collection back into the remodeled Reptile House, this animal somehow broke her lower jaw. Drs. Leonard J. Goss and Charles P. Gandal wired the fractured bones, but they failed to heal

and infection set in. It became necessary to amputate the lower jaw at the base in order to save the animal's life. This was skillfully done by the two veterinarians, the jaw healed beautifully and we had the only one-jawed Gavial in any zoo. The missing lower jaw is scarcely noticeable to the public and the animal has made a splendid recovery. Such an individual would starve to death in the wild, but in the Reptile House the keepers carefully feed her by means of forceps and she gets her full ration of fish along with the other crocodilians in the large pool.

We have been wanting to get some young Gavials to augment our outstanding collection of crocodilians. However, this is easier wished than done. The Society's good friend and Founder in Perpetuity, Mr. Saul Blickman, took an interest in this matter and determined that we should get young Gavials. Despite many setbacks, delays and difficulties, Mr. Blickman succeeded after two years in getting four young individuals as far as Calcutta. Further delays were experienced before the animals reached Mr. Humayun Abdulali in Bombay.

There the final bit of red tape tied them down. India had just placed an embargo on the shipment out of the country of all crocodilian hides. The local customs agent ruled that "since these animals are still in their hides" they could not be shipped to the United States! All of these delays worried us considerably because Gavials are difficult to feed at best and we were afraid the poor creatures would starve to death before they reached us. Mr. Blickman got in touch with the proper authorities and the Gavials, "in their hides," were soon on their way. No further difficulties were experienced and the four thin little Gavials reached the Reptile House safely on September 9. They were put in charge of Keeper Robert Raabe, who soon had all four of them eating greedily from long forceps. The animals have already filled out nicely and appear to be on their way to what we hope will be a long and pleasant life in the Reptile House. We can not tell the sex of our four youngsters, but there is a reasonable chance that at least one of them will be a male. When it grows up we hope it will get a really large protuberance on its snout so we can see one of the possible reasons for the interesting name "Gavial" — even if it is a misspelling.

(Part 3)

THE AMERICAN BEAVER

By ALBERT R. SHADLE

Biology Department, University of Buffalo

DEPENDING upon the altitude and the latitude, i.e., the higher above sea level and the farther north the area, the earlier the Beaver is faced with three important chores which have to be completed before hard-freezing weather covers its pond with a strong layer of ice. First, the family must cut, collect and store enough limbs and brush to supply its members with all the bark they will need for food throughout the winter, when they are unable to get fresh materials. Second, the family must complete any additional building or repairs which the lodge or lodges need; and third, must extend, raise the height, or repair any of the dams which need such attention to make them sufficiently watertight to insure a full pond of water all winter long. While the Beavers may be working more or less simultaneously on all three of these projects, we shall take up each one and follow it through as if the projects were completed consecutively.

The food harvesting and storing time is a very busy one and may be started while the leaves on the trees are still quite green. If there are aspens in the area, they will usually be the ones chosen for storage although other trees as well as bushes are also used. The regular process of felling, cutting into pieces, and transporting is followed in taking the cuttings to the chosen location. The pile or piles of stored food are usually located only a few feet or yards from the lodge or the bank den, so that the food is conveniently near the living quarters.

When the first brushy limbs are brought in for winter use, they are towed to the point in the pond where they are to be stored. If left floating at the surface, much of the material would stick out above the water and eventually dry up, so that it would soon be spoiled for food. Floating limbs might also drift away with the wind, or float away if there was an appreciable current.

The Beaver has learned to make sure that its food remains where it wants it. Seizing the first branch near the severed end, it dives with it, pulls it to the bottom of the pond, and, giving its head and neck several sharp jerks to one side, shoves the cut end of the limb as deep as it can into the mud of the bottom of the pond, thus holding it submerged where the water will keep the bark fresh for a long time. More branches are brought and anchored in the bottom, or stuck in among the others, and as the pile accumulates and the wood becomes waterlogged, the mass on the floor of the pond forms a dense tangle of many dismembered trees and bushes. These food piles vary greatly in size, depending upon the number of Beavers in the family and the abundance of food materials. They may measure six to nine feet wide, twenty-five feet or more long, and four or more feet deep. The coolness of the water tends to preserve the freshness of the bark and soon the thick ice seals the top of the pond. Thereafter the Beavers are confined largely to their lodge or lodges where they spend much time sleeping, eating and resting. When they are active, they go out through a burrow into their pond and swim about at will, but to breathe and renew their oxygen supply they must go back up into the den, or use bubbles of air trapped under the ice. When a Beaver wants food, it swims to the food supply, cuts off a piece of wood with the bark on it, returns with it to the lodge and leisurely gnaws off the bark, then takes the peeled piece out and drops it into the water outside the lodge. Since the wood is waterlogged, it sinks to the bottom. These discarded pieces are often used the following season for building and repairing.

The second important fall chore is the repairing and reconditioning of the living quarters. During the summer, little is usually done to the lodge, but with the family growing up and need-

ing more room, some enlargement of the den cavity is usually necessary and this may involve adding material over the whole lodge. The enlargement is accomplished by digging and cutting away the walls and the ceiling of the den cavity, which necessitates adding more sticks, etc., to the outside of the lodge to thicken its walls. Discarded pieces of peeled sticks and limbs, either old or fresh, are collected one by one and brought to the lodge where they are carried or dragged up on it and dropped somewhere haphazardly. Since the heavier pieces are usually dragged by one end as the Beaver walks up on the lodge, many of them will lie pointing roughly from the base towards the peak, but the positions are rather irregular and hit-and miss. After a liberal supply of sticks has been added, the addition of the plaster coat is begun. Diving to the bottom of the

frosty morning when the moisture-laden warm air coming from the inside of the lodge condenses into vapor as it strikes the cold outside air above the peak. The sticks at the top are so numerous and form such a thick criss-crossed layer that one can never see down through the ventilator.

The third important fall work is attention to the dams. Throughout the summer, the Beavers are likely to pay little or no attention to their dams unless they have been unexpectedly damaged by high waters or by man so that the water of their pond is rapidly lowered, for then immediate repairs are necessary.

Spring is the time when high waters are likely to cause most damage to the dams by washing away more or less of their crests. This damage is usually promptly repaired. Weak dams built entirely of small willow cuttings are susceptible to

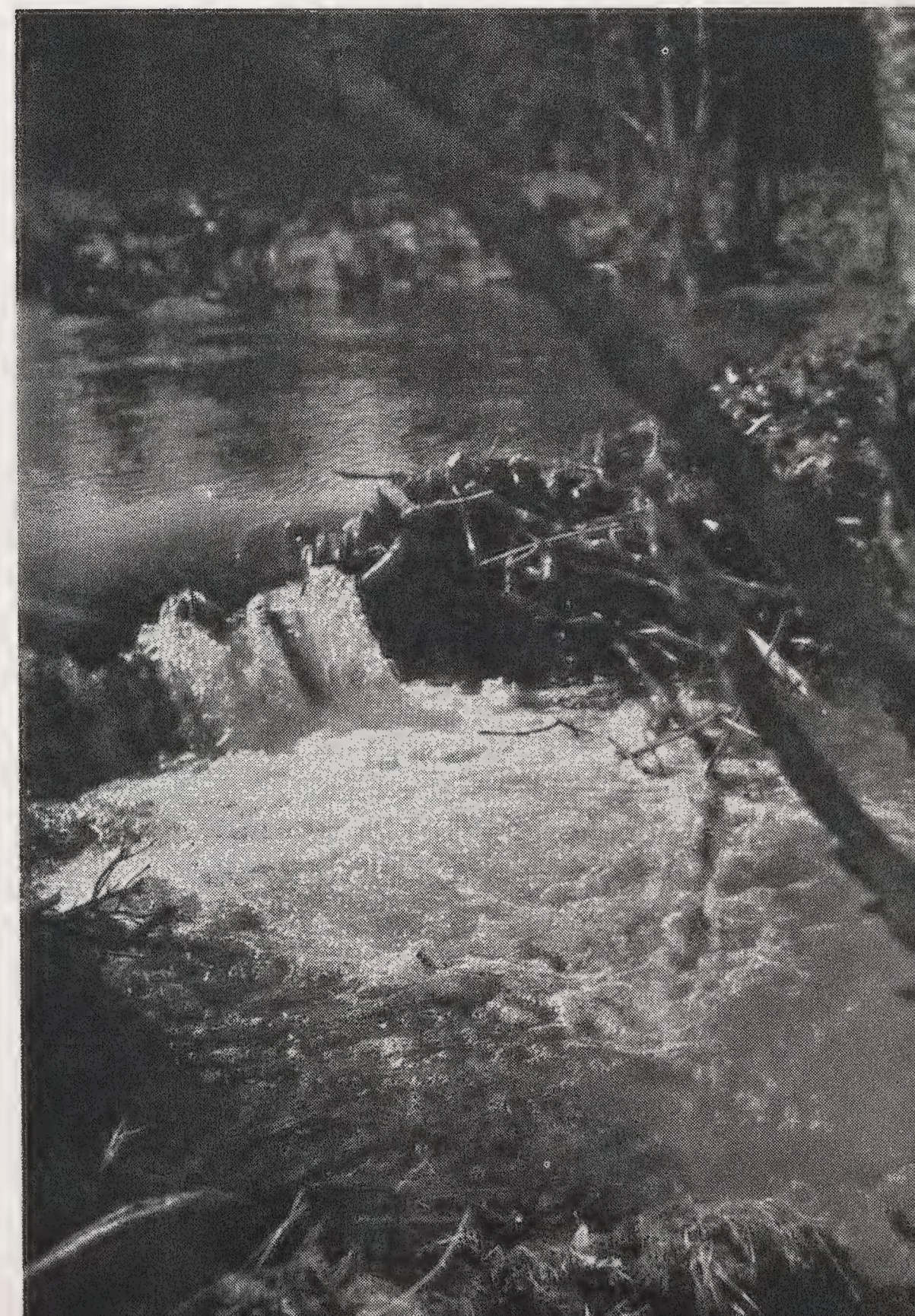


An island lodge in August, before the sticks are plastered with mud. Logs in the water are felled trees too large to be handled by Beavers.

Photo by R. D. Fraser

Dams built entirely of small brush material like this one may be damaged or even completely washed out by heavy rains or in spring floods.

Photo by R. D. Fraser



pond, the Beaver gathers with its fore limbs a load of mud, leaves and other debris and floats to the top. Then swimming to the lodge, it waddles on its hind legs up the structure to deposit the soft material upon the sticks. In this way, several inches to more than a foot of sticks and mud are added to strengthen the walls. Whether by accident or intentionally, we do not know, but the sticks at the peak are never solidly plastered together like the remainder of the lodge. Thus there is an opportunity for ventilation and change of air through the thick unplastered layer at the peak. This can often be demonstrated on a cold,

considerable destruction, sometimes by a single hard summer downpour and a heavy flow of water. In late summer and early fall, Beavers become actively interested in the condition of their dams and at this time many of their damming operations occur. Old ones are repaired and often raised along the entire length and may be extended at one or both ends. New dams are constructed to supplement the old ones and increase the home area to accommodate the increase in the Beaver family. In these operations great volumes of materials are transported and used in preparation for winter.

When these three chores have been completed, the Beavers are prepared for the long, cold winter days and nights for they will usually be confined to their living quarters and the water surrounding their lodge after the pond is completely frozen over. These periods of confinement are spent in loafing, sleeping, tearing pieces of wood into shreds for bedding, swimming for exercise and play under the ice, and in cutting pieces of food material from the food pile in cold storage nearby. So one can understand why the Beaver lives a very sleepy, lazy life throughout the winter months and is not the "busy Beaver" it is supposed to be.

The young males and females pair up when they are approximately two years old, and choose a location to establish their own home. They breed during the winter and after a gestation period of about three months, the young are born — usually in April or May, in the bank den or in the lodge. The number of kits averages three or four, but may vary from one to eight. Even ten have been reported. At birth, the kits weigh from eight to twenty ounces or more, are fully furred with a soft brownish fur, their eyes are open, and they walk about readily. The young grow rapidly, usually weighing 10 to 15 pounds at nine months, and 20 to 27 at a year. They remain with their parents until they leave or are driven out of the family when they are almost sexually mature and ready to establish their own home and rear a family.

Such a Beaver family (parents and young) may number four to six the first year. When the female is about to give birth to her next litter, the following spring, the male and the yearlings have to leave the main den or lodge, for by that time

the family will have built one or more additional dens or lodges where these will live, while the mother and the new kits remain in the main lodge. They all work together on the various projects and the whole group is often referred to as a colony of Beavers. A large number is an advantage when there is a great deal of work to be done in building dams, canals, lodges and dens. However, large colonies require great quantities of food for winter subsistence, and the numbers of trees cut and the amount of food stored by such a colony often make very large piles.

Adult Beavers generally respond to sounds, to things which they see, and particularly to moving objects. The male appears to be more cautious and excitable than the female. When frightened by something nearby, he strikes the water with his tail and dives quickly. If he is only suspicious or is disturbed by something, he is likely to swim rapidly back and forth, watching intently, alert for anything which might necessitate prompt action. Once assured that all is not well, with his tail he gives one or more hard slaps on the surface of the water and dives quickly, often to reappear shortly for another surveillance. In a quiet woodland, such slaps of the tail can be heard for a considerable distance and may be followed by the slaps of other Beavers in the area. If he is close to the lodge and there are young in the colony, the male appears even more careful than usual and he is likely to dive and enter the safety of the lodge or a neighboring bank burrow where he may remain for some time.

The female appears to take a much more leisurely, casual attitude. I have often seen her pay little or no attention to the excited actions of the male until he had given a number of warning slaps. She then ceased her feeding or other activity, to make observations herself or to seek refuge out of sight. She seems to be quite alert to the activities of the young and watchful for their safety. Like all young animals, the kits often take chances which the adult does not take, and I have frequently seen a mother actually prevent a kit, and in one case a yearling, from coming out on the bank in response to my imitation of a Beaver call. Each time, the female swam up behind the young animal and, putting one of her fore paws on each hip of the young, definitely and with force turned it away from the bank and out into



the pond, thus putting herself between the young and me. One recalcitrant kit which insisted on coming to me was seized by the mother and pushed ahead of her as she swam out into the pond. The kit struggled to get away from her and four times she pushed and held the young under water for three seconds or more, before it finally ceased its struggling. By that time, the mother had pushed it well out from the bank. After the baby had given up, the parent headed it towards the lodge and released it. It apparently had learned its lesson, for it did not try again to come back to me. Another mother treated her yearling similarly. She swam up behind it, caught it by the thighs, swung it around in the water, and started it back across the small lake towards the lodge.

Some people consider Beavers very destructive animals and want to keep them out of the woods, while others strongly maintain that they do no harm at all and are really beneficial animals. Both points of view cannot be wholly true, so it will be

A nursing Beaver surrounded by her kits. The number of young is usually three or four, but there may be only one or as many as eight or ten. This family is exceptionally large. Kits are only a few days old.

Photo H. Hinrichs, from National Audubon Society

necessary for us to look into the real evidence and then try to draw unbiased conclusions.

On the debit side of the account, Beavers do cut goodly numbers of trees and shrubs for food and building projects, but much of this material — willows, alders, blue beech, shadbush, etc. — are of little or no commercial value. Aspens and birch are usually too small to be of commercial value, unless they are to be used for pulp wood or for lumber. Beavers do occasionally flood and kill some good timber trees, but the numbers so lost are usually an insignificant part of the whole woods, and even the lumber from these dead trees could be salvaged if done promptly, so that these losses are not of much importance. Of the whole wooded area, the amount destroyed by these ani-

imals and by their dams is usually only a small fraction of one percent.

If one compares the amount of damage done by Beavers with the amount done by man's own waste of trees and forest potential in his lumbering operations, and by fires which he causes, or with the wind damage by storms or by the insect destruction and the loss from diseases, which in many cases man has brought into the country, then we find the damage done by the Beaver hardly worth mentioning.

In small parks, private estates of a few acres, and homesteads where there are special plantings of shrubs and trees for reforestation and for shade, cutting and damming by Beavers can be very destructive and the results of careful planning and costly investment may be destroyed. In such cases, the immediate removal of these animals is definitely justified and is mandatory.

Beavers often build dams which block small bridges and culverts along railroads and public roads. They can be quite destructive by flooding tracks and roads. Sometimes gravel roads are actually washed away and must be rebuilt. These are what are known as "nuisance Beavers," and their removal is generally promptly accomplished by the State Conservation Department when the situation is called to its attention.

On the credit side of the account, the Beaver has always been active and consistent in its conservation of water, for by damming and storing the water in its ponds, rapid runoff is retarded and more of the water soaks into the soil to supply the essential water. This stored water is also important in maintaining the flow of water through the hot dry periods of the summer when the streams might otherwise go dry.

Beavers also aid in soil conservation through

the partial control of erosion by water. When soil-laden water stands in the Beaver ponds, the soil particles settle out and are deposited as silt on the bottom, where it builds up what eventually become low, fertile, grassy areas known as Beaver meadows. Beavers thus help to keep the eroded soil from getting farther down where it fills the stream channels, increases floods, hinders navigation and damages harbors by filling them with silt.

Beaver ponds are of great value to all sorts of wildlife, both plant and animal. Characteristic plants and small invertebrates abound in such habitats. Fish, amphibians, many insects and even some of the birds find these ponds excellent reproduction areas. Herons, ducks, insect-eating birds, amphibians, turtles, snakes, raccoons, mink, porcupines, deer, bears, weasels, foxes, and many others find food, water and cover to protect them in and around the ponds. The Beavers are very hospitable and everything is welcome in their area. The excess Beaver population annually produces a large and valuable crop of furs and these furs count heavily in favor of the animals.

After studying all of these points, I am inclined to believe that we must consider the Beaver one of the most interesting and desirable wildlife forms. If you are still undecided in your point of view, spend a few evenings with a Beaver family at its pond. That should definitely help you to make a decision. Knowing something of the Beaver's history and habits and having gotten acquainted with it by watching it go about its regular activities around its lodge and pond, we can hardly help becoming ardent advocates of the perpetuation of this distinctive early American.

News from the Conservation Foundation

League of Women Voters Studying Conservation

The League of Women Voters has adopted as part of its national program the study of conservation of water supplies, and has recommended as essential background reading two of the Foundation's publications: "Concepts of Conservation, A Guide to Discussion" and "A Conservation Handbook" by Samuel H. Ordway, Jr., first published by the Foundation in 1949. This latter book has now gone through three printings and a new edition was issued this fall.

Adult Education

The Fund for Adult Education, created by the Ford Foundation, has requested the assistance of our organization in planning its proposed new adult discussion program on the subject of Natural Resources and People. Discussion guides, selected readings and audio-visual aids are among the media to be used to stimulate discussions.

Olaus Murie's Report on Alaska

The expedition headed by Dr. Olaus Murie has returned from an extended visit to the Brooks Range in northern Alaska. The purpose of the trip was to survey the fauna and flora and report on the desirability of establishing a wildlife refuge or reserve in the region. One or more illustrated articles concerning this expedition will be published later on in *ANIMAL KINGDOM*. The project was jointly sponsored by the Conservation Foundation and the Zoological Society.

Educational Television

The Metropolitan Educational Television Association, of which Fairfield Osborn is a member of the Board of Directors, has sought the assistance of the Foundation in the preparation of its first education program series which will be devoted to natural resources and conservation. META has recently received substantial grants to assure continuing production and broadcasting of educational programs in the metropolitan area.

Our Educational Program

Prof. Elizabeth Hone of Los Angeles State College is undertaking educational research in connection with phases I and II of our study of the quantity and quality of conservation teaching in the school systems of the United States. In connection with this project Mrs. Martha Munzer and Paul Brandwein are now completing the manuscript of their book on teaching science through conservation, which will be published in due course.

Resources and Political Action

The Rockefeller Brothers Fund has launched a special project for panel consideration of the most important problems related to political progress and social welfare which will confront government in the next decade or more. Representatives of the project have requested our staff to prepare a paper, or papers, related to resource problems and opportunities which should concern Federal or State governments.

Society of Agronomists Meeting

Robert Snider, our Director of Research, delivered the principal paper on water resource problems before the Society of Agronomists at Cincinnati in November.

Conservationists in Industry

Roger Hale, in charge of our project to ascertain opportunities for resource specialists trained in graduate schools at a number of American universities, has been asked to address a meeting of representatives of the Forest Products Industries to discuss the values of graduate resource training in industrial employment.

New Trustees

H. J. Heinz, II, and James Cagney have been elected members of the Board of Trustees of the Conservation Foundation.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Staff Appointments and Changes

Dr. John Tee-Van, Director of the Zoological Park since 1952, has been given the title of General Director of the Zoological Park and the Aquarium, and at the same time Christopher W. Coates, Curator and Aquarist of the Aquarium since 1944, has been made Director of the Aquarium.

On November 15 William G. Conway became Associate Curator of Birds. Mr. Conway, a graduate of Washington University and former Curator of Birds at the St. Louis Zoo, is a well-trained and experienced ornithologist and comes to us with the strong recommendation of the St. Louis Zoo.

Charles Driscoll, Assistant Superintendent of Construction and Maintenance since 1952, has been made Superintendent of Construction and Maintenance, replacing the late Quentin Melling Schubert.

Komodo Monitors Gain Weight In Past Eighteen Months

It has been obvious for some months that the two Komodo Monitors in the Reptile House are putting on weight, for their skin is tight and their tails are plump and rounded. Weighing presented some difficulties, however, for Curator Oliver was reluctant to disturb them by forcing them into a box so they could be moved to a platform scale.

The problem was solved in October by bringing the scales to the lizards. A special platform was built to hold the reptiles, which are almost nine feet long. The female, always less excitable than the male, has been weighed in a test of the apparatus, and it was found that she has increased from 109 to 131 pounds, a gain of 22. It was quite easy to induce her to walk onto the platform; an egg (of which she is very fond) was

held in front of her nose, and she followed it willingly.

The male will be weighed in the next week or two. He appears to have gained as much weight as the female, or more.

Newsletter from Fiji Brings Praise from Members

Jocelyn Crane's "South Pacific Expedition Newsletter," mailed from Fiji to all Members of the Zoological Society, has had a warm response from the membership. Some of the comments sent to the Society and to Miss Crane were:

"... what a wonderful surprise — the letter from the Fiji Islands!"

"... what pleasure you have given the numerous members of the Zoological Society with your hilarious account — and yet educational too — of your South Sea experiences!"

"... I found your letter fascinating and hope you will write many more."

"... I will treasure the stamps for my collection. How much more fun to receive a report like this than a stereographed one from the office in New York!"

(From a publisher): *"... would you consider writing a popular book for us about your experiences?"*

State Museum Publications

A new list of sales publications has been compiled by the New York State Museum and is available without charge on request to the Museum at Albany 1, N. Y. It includes a considerable number of zoological bulletins, circulars, handbooks, etc., that were formerly considered out of print and have been available only through dealers. The stock of some of these items is small; in such cases, preferences will be given to orders from libraries of universities, foundations and other organizations.

IN BRIEF

Penguin Egg Stopper. To prevent a recurrence of the past year's accident, when a King Penguin egg rolled off the feet of the incubating bird in the Penguin House, dropped over the ledge into the pool and was broken, cement copings have been constructed at spots which seem to be favorites of the birds. It remains to be seen whether the Kings will lay next season and whether they will take advantage of the protective coping.

Warsaw Exchange. Chinese Alligators are comparatively rare in collections — there is some evidence that they may be extinct in their homeland — and we therefore welcomed an exchange with the Warsaw Zoo in Poland whereby one of their three specimens came to us in return for a collection of North American snakes. The alligator is 47 inches long (it reaches a maximum of about 60 inches) and weighs 12 pounds. Other new arrivals in the Reptile Department include our first Amethystine Python from Australia, a snake that attains a length of 22 feet and is said to prey on Wallabies. Ours is 8 to 9 feet long. From Sir Edward Hallstrom and the Taronga Park Zoo in Sydney we received a nice collection of Red-bellied Black Snakes, Tiger Snakes, Blue-tongued Skinks and a magnificent Bearded Lizard.

PUBLICATIONS OF INTEREST

FAMILIAR ANIMALS OF AMERICA. By Will Barker. 113 drawings by Carl Burger. xv + 300 pp. Harper & Brothers, New York, 1956. \$4.95.

However familiar the animals of our own country may be, there are always new observations to be recorded and new syntheses of the familiar and not-so-familiar

facts to be made. "Familiar Animals of America" covers well-travelled ground, but does it in such a thorough and workmanlike, yet readable, way that it must be welcomed wholeheartedly into the company of books about American animals. Here are the appearance, the size, the habits, the longevity, the food — in brief, the life history — of half a hundred mammals and a generous share of the reptiles and amphibians of this country, enlivened frequently by anecdotes and personal observations. Carl Burger's drawings are superb and will give new ammunition to those who believe that the artist is mightier than the photographer. — W. Br.

IOWA FISH AND FISHING. By James R. Harlan and Everett B. Speaker. 377 pp., 63 illus. in color by Maynard F. Reece. Many black-and-white illus. Published by the State of Iowa (State Conservation Commission), East 7th and Court Ave., Des Moines 9, Iowa. Third edition, 1956. \$2.50. Color plates (18 illus., 63 fishes) available separately for \$2.00.

When the first edition of this remarkable book was published in 1951, it was widely hailed as a model that any State might be proud to copy, and praise was lavished especially on Mr. Reece's color illustrations of Iowa fish. Now comes the enlarged third edition with nine new color plates and textual additions, corrections and revisions totalling 140 more pages. For the freshwater fisherman, this is more than ever the best book buy he is ever likely to make. Its aim is to point out where to fish (in Iowa), the identification of fish caught, and how to catch them. "Identification" and "How to Catch" are applicable in pretty nearly any part of the United States, and the sections on where to fish in Iowa should draw fishermen from all over to that lush, green and lovely State. — W. Br.

EVOLUTION, GENETICS, AND MAN. By Theodosius Dobzhansky. ix + 398 pp., illus. John Wiley and Sons, Inc., New York, 1955. \$5.50.

Evolution is the most inclusive of biological subjects and therefore one of the most complex. It is indeed fortunate that the challenge of presenting evolutionary facts and theories in lucid and readable English has been met by a series of masters of scientific exposition and style, of which Darwin himself was the first. Dr. Dobzhansky is one of the present day biologists maintaining this laudable tradition, and in this, his latest book, his mastery over both the subject and its elucidation is most apparent. Although written as an elementary college text, the layman with no more than a high school knowledge of biology can read this book with little difficulty and much profit. — J. W. A.

New Members of the New York Zoological Society

(Between September 1 and October 31, 1956)

Life
Mrs. Samuel Dushkin

Contributing
Clarence Avildsen
Dana T. Bartholomew
Walter Beinecke
Wiley Blair, Jr.
Milton J. Blume
Mrs. C. Neuman De Vegvar
Dr. Alvin M. Donnenfeld

W. A. Flagg
Reginald Gray
Mrs. Edward Hutton
Dr. Frederic T. Kirkham, Jr.
Mrs. Iris D. Knight
Rufus H. Knight
Frank Y. Larkin
B. C. Ohlandt
Auguste R. Pottier
Harry A. Russell
Dr. Irving Alfred Shey

Dr. Raymond Sobel
Dr. Emery Szanto
H. E. Talbott
Dr. H. L. Temple
Mrs. Percyval Tudor-Hart
Dr. Jerome A. Urban
Ulysses D. E. Walden
Annual
Dr. Samuel Allentuck
Mrs. Paul L. Anthony
Dr. Edmund Applebaum

Mrs. Lee Ault
Herbert R. Axelrod
Mrs. S. G. Barton
Dr. Robert Bastian
Dr. Thomas W. Baylek
Dr. Emanuel Blumenfeld
Mrs. Harris H. Bucklin, Jr.
Benjamin R. Burdsall
Thomas V. Callahan
Dr. George James Capurso
Dr. John Cardillo
Theron A. Clements
Dr. Herbert George Cohen
Edgar M. Cullman
Miss E. C. Dearden
Mrs. Julius Dobkin
Miss Ethelwyn Doolittle
Harold L. Drimmer
Dr. Mortimer Dubovsky
Mrs. Samuel G. Dunham
Dr. Sol Engel
Dr. B. D. Erger
Benjamin T. Fairchild
Dr. Anthony J. Fassino
Dr. William J. Foster
Dr. Richard L. Frank
Mrs. David S. Gamble
Dr. Francis G. Geer
Dr. Edward Gendel
Dr. Nathaniel Goldrich
Mrs. Herbert S. Goodman
Mrs. Joseph Goodman
Dr. Adeline S. Guttelman
Dr. Edward A. Hardy
Allen Harris
Dr. Samuel Hemley
Mrs. Ethel A. Henderson
Joseph Hofheimer
Dr. Hilary H. Holmes

Dr. Calderon Howe
Miss Dena Humphreys
Mrs. James N. Hynson
Mrs. Carle Jackson
Mrs. David S. Jackson
Mrs. George W. Jaques
Dr. Arthur R. Kahn
Dr. Leo R. Karmin
Keith Allyn Kimball
Philip H. Kirshen
Dr. Morris Kleinfeld
Ira Kornblum
Dr. Sheldon Kotkin
Kenneth Krasnow
Mrs. Gerard Lachman
Dr. Arthur J. Lapovsky
Dr. Vance Lauderdale, Jr.
Robert E. Leoni
Dr. J. M. Leventhal
Mrs. Milton Levine
Morris L. Levinson
Dr. Samuel Lieberman
Dr. Irving Light
Master Michael Pardo Livingston
Dr. S. Arthur Localio
Dr. Charles L. Lumb
Dr. Joseph L. Mangiardi
Dr. Francis T. Mathus
Miss Dorothy P. McAlpin
Alfred P. Minervini
Dr. Solomon J. Mink
George A. Mitchell
Dr. Norman Morrel
Mrs. Saul Mulwitz
Dr. James S. Murphy
Dr. Henry B. Nachtigall
George F. Nagl
Dr. Jane Northup
Miss Edith E. Nyman

Dr. Girard F. Oberrender
Mrs. Howard M. Pack
Joseph John Pezzullo
Miss Elsie Jean Quigly
Stanley R. Resor
Master Bobby Reynolds
Mrs. Philip Rhinelanders
Mrs. Edward L. Richards
Dr. Julian Rieser
Dr. J. S. Ritter
Dr. Elizabeth Rockwell
Robert Rose
Dr. Morris Rosenberg
Harvey Rothnagel
Miss Jacqueline Nancy Rothstein
Rev. Mother Ruth, C.H.S.
Dr. Jacob N. Satozky
Moulton Sawin
Mrs. Victor Scheinman
Richard Schlosberg
Dr. Harry Schneider
Dr. Louis A. Schultz
Dr. Raymond Shapiro
Dr. Edward J. Shaw
Dr. Howard B. Shookhoff
Dr. Tom G. Stauffer
Mrs. Sidney Steinhauer
Henry Z. Steinway
Mrs. Clarence R. Straatsma
Dr. Robert A. Sussman
Dr. Arthur M. Sutherland
Dr. Gilbert H. Taylor
J. G. Thacker
Mrs. Cyrus R. Vance
William H. Van Dusen
Mrs. Kathrin Grant Verney
Miss M. Wendy Walter
Dr. Hazel S. Wilhelm
Mrs. Henry D. Witte

INDEX

Figures in **black type** indicate that the reference is to, or includes, an illustration, map or design.

A

“About the Bronx Zoo,” folder offered, 64
Africa, status of wildlife, 170
Alligator, Chinese, new arrival, 188
Altmann, Margaret, “The Chamois,” 137
Amblyrhynchus cristatus, **148, 149**
“American Bison, The,” selling out, 92
Anhinga, burr on beak, 126
Anteater, Giant, **44**
 Silky, **44, 45**
Apodemus sylvaticus, 120
Aquarium, Coral Reef tanks, **174**
 entrance hall, **174**
 exterior, **173**

 parking lot opens, 158
 under construction, **84, 85**
Aramides cajanea, 55
Armstrong, Joseph, fish named for, 31
Aspatha gularis, 55
Atz, James W., “In a Way, the Lungfish Is a Missing Link,” 57
 “‘Our Upside Down Catfish Grow Up,” 141
Auriparus flaviceps, 55
Axolotl, **59**

B

“Balance of Nature,” 116-123
Ballou, George, presents mice, 114
Bananaquit, 55

Barbet, Prong-billed, 55
Barton, Otis, presents Marine Iguanas, 149
Baruch, Bernard M., 61
Bassaricyon alleni, 110
 gabbii, **110**
Beaver, American, **98, 100, 102**
 and kits, **184**
 carrying young, **155**
 dam, **153, 182**
 lodge, **99, 152, 182**
 tree felled by, **103**
Beebe, William, Introduction to “Flying Reptiles,” 11
Bee-eater, European, **47**
Belgian Congo, rare fishes from, 62
Bell, Joe, with Bateleur Eagle, **115**

Bighorn Crag, Idaho, **6**
 Bighorn Sheep, **2, 3, 7-9**
 Blickman, Saul, presents Gavials, 180
 Boa, Guatemalan, **56**
 Bobolink, 55
 Bogert, Charles M., "The World's Only Venomous Lizards," 105
 Books reviewed:
 "Windward Road, The," 32
 "Studies of the Psychology and Behavior of Captive Animals in Zoos and Circuses," 32
 "Pet Alligators," 32
 "Reptile World, The," 32
 "Paws, Hoofs and Flippers," 64
 "Bats," 64
 "Outdoor Hazards, Real and Fancied," 64
 "How to Catch Salt Water Fish," 64
 "North American Birds of Prey," 64
 "A Bibliography of References to Diseases of Wild Mammals and Birds," 64
 "An Australian Animal Book," 64
 "Guide to Photographing Animals," 127
 "Biology of the Amphibia, The," 128
 "Finches," 128
 "Spring on an Arctic Island," 160
 "An Atlas of Animal Anatomy for Artists," 160
 "Familiar Animals of America," 188
 "Iowa Fish and Fishing," 188
 "Evolution, Genetics and Man," 188
 Brandwein, Dr. Paul, 29, 157, 186
 Bridges, William, "Anteaters Become Milk-egg-meat-eaters in the Zoo," 43
 "Report on the Aquarium," 84
 "We Are Moving into the Aquarium," 173
 Buechner, Helmut K., "The Future of the Bighorn Sheep," 2
Bufo blombergi, **189**
 Bustard, Kori, new arrival, **145**

C

Cabeza Prieta Game Range, Bighorn Sheep in, 5
 Cagney, James, 61
 Conservation Foundation trustee, 186
Campylorhynchus zonatus, 55
Capra falconeri, **22**
 Carlisle, Donald T., death of, 91
 Catfish, Upside Down, **142, 143**
 Census, animal collections, 62
Centurus rubricapillus, 55
Chaetura pelagica, 55
 Chamois, **137-140**
 Chicago Zoological Park, exchange with, 31
 gets Okapi, 163
 Chimpanzee, Black-faced, **18**

climbs wall, **92**
 identification of, 30
 Pigmy, **18**
 playing, **48, 49**
 Schweinfurth's, **18**
 White-faced, **18**
Chiroxiphia pareola, **89, 90**
Clethrionomys glareolus, 120
 Coates, Christopher W., made Director of Aquarium, 187
 Coati-mundi, "Snoopy," **16, 17**
 Cobra, King, deposits eggs, 91
 eggs spoil, 126
 mating, 31
 Coder, Jim, shearing sheep, **93**
Coereba flaveola, 55
 Collins, Pat, "My 'Komodo Dragon' Circus," 34
 Congo Peacock, to U.S.N.M., 93
Coniophanes quinquevittatus, 76
Conolophus subcristatus, 151
 Conservation Foundation notes:
 Address to Forest Products Industries, 186
 Conservation and League of Women Voters, 186
 Conservation at U. of Louisville, 157
 Conservation education program launched, 124
 Crop yield research, 29
 Educational film royalties, 61
 Fairfield Osborn at I.U.P.N. meeting, 125
 Films used by Canadian TV, 30
 Fund for Adult Education assisted, 186
 Graduate resource training, 61
 House organ features, 158
 James Cagney narrates radio program, 61
 META assisted, 186
 Murie returns from Alaska, 186
 New Jamaica project, 158
 New trustees named, 186
 No easy cure for over-consumption, 124
 Prairie Dog book written, 157
 "Prosperity Beyond Tomorrow," new book, 30
 Regional resources planning, 125
 Research on conservation teaching, 186
 Resource planning at Princeton, 61
 Rockefeller Brothers Fund assisted, 186
 Society of Agronomists meets, 186
 Study of conservation teaching, 29
 Teaching manual being tried, 157
 "Today and Tomorrow" radio series, 29
 Water law symposium held, 125, 157
 Conway, William G., made Associate Curator of Birds, 187
 Courtship display, by Manakins, 86
 Crab, Fiddler, **134**

habitat at Penang, **135**
 in Singapore, **133**
 being studied, **130**
 Crandall, Lee S., "There Was a Story Behind Our First Inca Tern," 20
 "Our First Pileated Woodpecker," 123
 Crane Hawk, Gray, new arrival, **115**
 Crane, Jocelyn, "Looking for Clues to Crab Evolution," 130
 praise for Fiji Newsletter, 187
 to South Pacific, 125
Crotalus adamanteus, 79
 atrox, 79
 horridus horridus, 79
Ctenopoma acutirostris, 62
Cyclopes didactyla, **44, 45**
Cyclura macleayi, 151

D

Dapper, Eleanore, photographs by, **113**
 Death Valley National Monument, Bighorn Sheep in, 6
 Deer, European Red, **Cover No. 2**
 Malay Sambar, dies, 32
Dendrocopos villosus, 55
 Desert Game Range, Bighorn Sheep in, **3, 5**
 Dingo, pups born, **19**
 Display, courtship, 86
Distichodus, 62
Dolichonyx oryzivorus, 55
Draco volans, **11, 12**
 Driscoll, Charles, made Superintendent of Construction and Maintenance, 187
Drymarchon corais couperi, 79
 Dunton, Sam, book by, 127
 on B.P.A.A. committee, 159
 Zoo photographs by, **16-19, 47-49, 80-83, 112-115, 144-147, 175-177**

E

Eagle, Bateleur, new arrival, **115**
 Education Department, service to schools, 16
 Eel-cat, new arrival, **144**
Elaenia flavogaster, 55
Elaenia, Yellow-bellied, 55
 Elephant, bathing at Epulu, **167**
 bobby pin in foot, 93
 "Candy," begging, **112, 113**
 "Pinky," begging, **112, 113**
Equus onager, **25-27**
Eumomota superciliosa, 55

F

Fagan, Charles L., brought Inca Tern, 20
 Farm-in-the-Zoo, sheep shearing, **93**
 Flicker, saved from snake, 126
 Flores, in Lake Peten, **75**
 Fort Peck Game Range, Bighorn Sheep in, 10

Flycatcher, Boat-billed, 55
Gray-capped, 55
Yellow-olive, 55
nest of, 54

G

Gavial, Indian, 178, 179
Gavialis gangeticus, 178, 179
Gecko, "Flying," 13, 14
Gibbon, White-handed, born, 31
learning to climb, 95
Gila Monster, 107
Giraffe, 66, 67, 69-73
and Kilimanjaro, 171
white, 73
Golden-eyes, new arrival, 32
Goodwin, George G., "Nature's
Skyscrapers," 66
Gordon, Myron, "Platyfish Come from
Strange Places," 74
to Hawaii, 31
Gorilla, "Oka," enjoys swing, 82, 83
Graham, Ralph, "Muyoni, Our New
Female Okapi," 162

H

Hallstrom, Sir Edward, gives reptiles,
188
Hart Mountain National Wildlife
Refuge, Bighorn Sheep in, 10
Hedgehog, Palestine Long-eared, 127
Hediger, Dr. H., observations on
Beavers, 155
Heinz, II, H. J., Conservation
Foundation trustee, 186
Heloderma horridum, 105, 106
suspectum, 107
Hemigrammus armstrongi, 31
Henicorhyna leucophrys, 55
Hinnekamp, George, with Onager, 27
Hippopotamus, death of Phoebe I, 160
in Albert National Park, 172
Phoebe II and Peter, 175
Phoebe II arrives, 160
Hirundo rustica, 55
Holothurin, 93
Hone, Prof. Elizabeth, 186
Hubbs, Dr. Carl L., collected
platyfish, 74
Hummingbirds, sent to London Zoo,
160

I

Iguana, Cuban, 151
distribution, 151
Galapagos Land, 151
Green, 151
Marine, 148, 149
Iguana iguana, 151
Inca Tern, 20
Indigo Snake, longevity of, 79
Indonesia, protects Komodo
Monitors, 40

J

Jackson, Wyoming, Bighorn Sheep
range, 6
Johnson, Prof. D. Gale, 29

K

Kea, new arrival, 95
Kilimanjaro and Giraffe, 171
Kingbird, Tropical, 55
Kinkajou, 111
"Tinker," 16
Kittiwake, 55
Kofa Game Range, Bighorn Sheep
in, 5
Koford, Dr. Carl, writes on Prairie
Dogs, 157
Komodo, island of, 38
Komodo Monitor, 35-37, 39-42
gain in weight, 187
in new quarters, 94
offer to buy, 159
Kuster, Prof. Kimber C., presents
rare boa, 56

L

Lampropeltis doliata amaura, 79
Lemur, Black, baby born, 81
Lively, Dr. Charles, 29
Lizard, Gila Monster, 107
Gliding, 11-14
Komodo Monitor, 35-37, 39-42
gain in weight, 187
offer to buy, 159
Mexican Beaded, 105, 106
correct length of, 158
London Zoo, Hummingbirds sent to,
160
Longevity, Anteater, 46
snake, 79
Lungfish, baby, 58
Lungworm, in Bighorn Sheep, 8

M

Manacus manacus, 89
Manakin, Black-and-white, 89
Blue-backed, 89, 90
Golden-headed, display, 86, 88
Manville, Richard H., "This
'Kinkajou' Was Really the Very
Rare Olingo," 109
"Two New Animals: The Markhor
and the Saiga," 21
Markhor, 22, 175
jumping, 159
Suleiman, Cover No. 1
Martini, Helen and Fred, with Tiger
cubs, 126, 127, 146, 147
Helen, with Tiger cubs,
Cover No. 5
Massasauga, longevity, 79
McCrane, Marion, 16
magazine article by, 159
Megarhynchus pitangua, 55
Mesa Verde National Park, 6
Mice, Palestine Spiny, new arrivals,
114

Milk Snake, Louisiana, longevity, 79
Modernization, in Zoo, 63
Monitor, Komodo, 35-37, 39-42
gain in weight, 187
in new quarters, 94
new quarters for, 62
offer to buy, 159

Motmot, Blue-throated Green, 51, 55
Turquoise-browed, 55
Mouse, Wood, 120
Munzer, Martha, 157, 186
Murie, Dr. Olaus, 186
Myiozetetes granadensis, 55
Myrmecophaga jubata, 44
Myxomatosis, 116-123

N

"National Geographic Magazine,"
article by Marion McCrane, 159
N. Y. State Museum, publications
list, 187
Nigrelli, Dr. Ross F., heads N.Y.A.S.,
31
receives grant, 93
Nyala, on African Plains, 80

O

Okapi, capture and transport, 162-169
covered pit for capture, 164
loading ramp, 165
Muyoni, 162, 168
palisade runway, 165
signpost in Congo, 164
station at Epulu, 166
Olingo, new arrival, 110
Oliver, James A., 19
"A Rare Gift: The Guatemalan
Boa," 56
"Hortense Has No Tail to Tell," 77
"Lizards of the Sea," 148
"The Oddest-looking Crocodilian,"
178
Onager, 25-27
Opening dates, Zoo, 63
Ordway, Samuel H., book by, 30
Oryctolagus cuniculus, 116
Osborn, Fairfield, "A Field Study of
African Parks and Wildlife," 170
editorial: "We Owe it to Wildlife," 1
"Spring — Here and There," 33
"The Sea Around Us," 65
"Time and Change," 97
"No Limits to Science," 129
"The Rightness of Animals," 161
Otter, Florida, birth of, 31
growing up, 94
young, 63
Ovis canadensis californiana, 7
canadensis canadensis, 7
mexicana, 7
nelsoni, 7
Owl, American Barn, captured, 159
Hawk, new arrival, 49
Tawny, 121

P

Pan paniscus, 18
troglodytes schweinfurthii, 18
troglodytes, 18
verus, 18
Parasites, of Bighorn Sheep, 8
of Tamandua, 46
Penguin, Black-foot, hatched, 31

King, egg broken, 126
 "egg stopper," 188
Phago sp., 62
 Phillips, Bro. Eric, sends snakes, **127**
 Phipps, John H., presents Crane Hawk, 115
Phractolaemus ansorgi, 62
 Piculet, Olivaceous, 55
Picumnus olivaceus, 55
Pipra erythrocephala, **86, 88**
 Plath, Karl, 31
 Platyfish, Lake Peten, **76**
 Platypus, Duck-billed, go on exhibition, 91
 taken indoors, **188**
 tunnels exposed, **145**
 weights of, 188
 Plover, Golden, 55
Pluvialis dominica, 55
Polypterus sp., 62
 Pony Track, ponies shocked, 92
 Potter, Bronson M., "How Our New Onager Came to the Zoo," 24
 Predation, pattern changed by myxomatosis, **116-123**
Protostrongylus stilesi, 8
Ptychozoon kuhli, 14
 Python, Indian Rock, **48**
 Amethystine, new arrival, 188

Q

Question House, questions asked at, 93, 159
 Quinn, Keeper, with "Oka," **82**

R

"Rabbit Disease" in England, 116-123
 Rabbit, Wild, **116**
 damage by, **117, 118, 122**
 Rail, Wood, 55
 Rainey Gate, pictured on telephone directory, 93
 Rattlesnake, Eastern Diamondback, longevity, 79
 Swamp, 79
 Timber, "Hortense," **78**
 longevity, 79
 Western Diamondback, longevity, 79
 Reptile collection, record size, 31
 Reptile House, Swamp scene, **Cover No. 4**
 Reptiles, gliding, 11
 Rhinoceros, African Black, **80**
 Indian, **Cover No. 3**
Rissa tridactyla, 55
 Robin, American, 55
 saved from snake, 126
 Rocky Mountain National Park, Bighorn Sheep in, **8, 9**
Rupicapra rupicapra, **137-140**

S

Saiga, **23**
Saiga tatarica, **23**
 San Andres National Wildlife Refuge, Bighorn Sheep in, 5

School children, record visits to Zoo, 125
 Schubert, Quentin Melling, death of, 158
 Schultz, Prof. Theodore, 29
 Seal, Atlantic Harbor, **47**
 Harp, **47**
Semnornis frantzii, 55
 Shadle, Albert R., "The American Beaver," (Part 1), 98
 (Part 2), 152
 (Part 3), 181
 Sheep, Bighorn, **2, 3, 7-9**
 Marco Polo, new arrivals, 158
 Sheep-shearing, at Farm, **93**
 Shoshone National Forest, Bighorn Sheep in, 4
 Simla, D.T.R. Laboratory, **87**
 Singapore, Chinese shop, **136**
Sistrurus catenatus, 79
 Skutch, Alexander F., "The Bird's Nest as a Dormitory," 50
 Sleep, of birds, 50
 of Giraffe, **69**
 Snails, hosts for Lungworm, 9
 Snake, "Flying," **15**
 Snakes, exchanged for apparatus, 127
 Snow, D. W., "Courtship Ritual: The Dance of the Manakins," 86
 Southern, E. H., "Ecologists Are Excited by England's 'Rabbit Disease,'" 116
 Spencook, Steve, praised in letter, 96
 with Komodo Monitors, **94**
 with Python, **48**
 Staff, Zoo, changes in, 187
Strix aluco, **121**
 Swallow, Barn, 55
 European, 55
 Swan, Mute, cygnets hatched, **114**
 Swift, Chimney, 55
Synodontis acanthomonias, 62
 angelicus, 62
 nigriventris, **142, 143**

T

Tamandua, **43**
Tamandua tridactyla, **43**
 Tanager, Blue, 55
 Teachers' Course, in use of Zoo, 125
 Tee-Van, John, made General Director, 187
 Tern, Inca, **20**
 Tetra, Gold, 31
 Thrasher, Palmer's, 55
Thraupis episcopus, 55
 Tiger cubs, **Cover No. 5**
 "Castor" and "Pollux," **126, 127, 146, 147**
 Toad, Colombian Giant, new arrival, **189**
Tolmomyias sulphureus, 55
 Tortoise, Galapagos, Florida hatchling to Zoo, 159
Toxostoma curvirostre, 55

Treichel, George, field study in Africa, 170
Tripsurus chrysauchen, 55
Troglodytes musculus, 55
 troglodytes, 55
 "Tropical Wild Life in British Guiana," selling out, 92
 Tuatara, new arrival, **19**
Turdus migratorius, 55
 Tweedie, M. W. F., " 'Flying' Reptiles," 11
Tyrannus melancholicus, 55

U

Uca annulipes, 133
 dussumieri, 133
 manii, 133
 marionis, 133
 rhizophorae, 133
 triangularis, 134
Ungaliophis continentalis, **56**

V

Van Gelder, Dr. Richard G., presents Olingo, 111
Varanus komodoensis, **35-37, 39-42**
 Verdin, 55
 Vole, Bank, 120
 Vulture, Hooded, new arrival, 63

W

Walrus, Atlantic, at Aquarium, **176, 177, Cover No. 6**
 Warsaw Zoo, exchange with, 188
 West Flores, island, **34**
 Wild Ass, Persian, **25-27**
 Wildfowl Pond, reconstruction, **95**
 Wildlife in Africa, study of, 170
 Wolanek, Robert, with Dingo pups, **19**
 Woodpecker, Golden-naped, 55
 Hairy, 55
 Pileated, new arrival, 31, 123
 Red-crowned, 55
 Wren, Banded Cactus, 55
 nest of, **55**
 European, 55
 Highland Wood, 55
 Song, nest of, 50
 Tropical House, 55

X

Xiphophorus maculatus, **76**

Y

Yellowstone National Park, Bighorn Sheep in, 4
 Ylla, photograph by, **171**

Z

Zebra, Grant's, with foal, **144**
 Zoo Staff, changes in, 187
 Zoo tours, for Members, 60, 92



A gift of a Zoological Society Membership is

The PRESENT... with a FUTURE

For boys and girls — nephews, nieces, grandchildren — destined to be
scientists, artists, doctors, writers, teachers, architects, engineers —

For friends, animal lovers, the sensitive, the perceptive —

For all who enjoy the Zoo and the Aquarium —

Membership offers continuing rewards and year 'round enjoyment.

← USE THE CHRISTMAS GIFT CARD —

Membership is a Wonderful Present to give



W 1700 S

SMITHSONIAN INSTITUTION LIBRARIES



3 9088 01261 4624